ECOMM User Manual V 2.0 Europe

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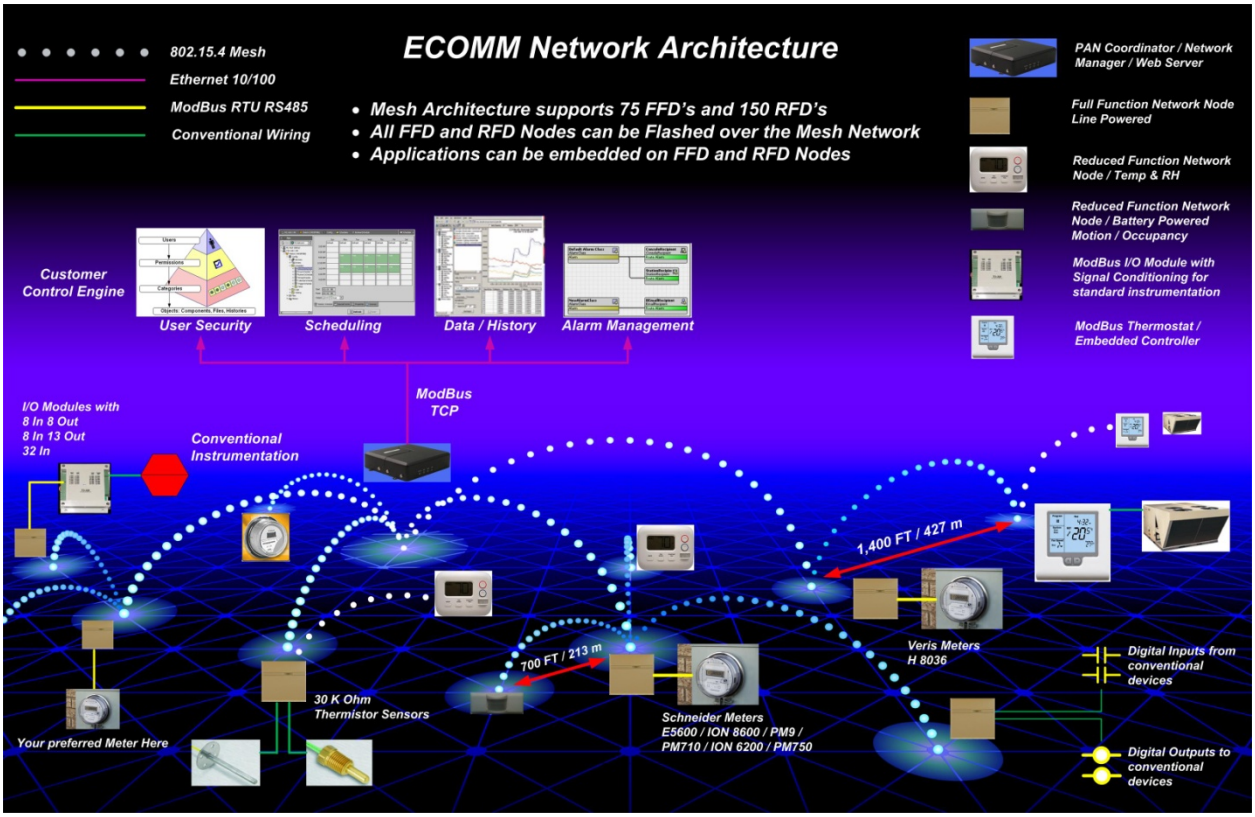
Table of Contents

Architecture	**Page 3**
Definitions	**Page 4**
Planning	**Page 5**
Wireless Geography	**Page 18**
Configuration	**Page 22**
Configuring FFD's	**Page 30**
FFD Register Maps	**Page 33**
Configuring RFD's	**Page 36**
RFD Register Maps	**Page 37**
Input / Output Modules Channel Function Selection	**Page 38**
EC1 Configuration Details	**Page 40**
Characterized 3rd Part Device Settings	**Page 48**

Architecture


ECOMM Network Architecture
802.15.4 Mesh
Ethernet 10/100
ModBus RTU RS485
Conventional Wiring
Mesh Architecture supports 75 FFD's and 150 RFD's
All FFD and RFD Nodes can be Flashed over the Mesh Network
Applications can be embedded on FFD and RFD Nodes
PAN Coordinator / Network Manager / Web Server
Full Function Network Node Line Powered
Reduced Function Network Node / Temp & RH
Reduced Function Network Node / Battery Powered Motion / Occupancy
ModBus I/O Module with Signal Conditioning for standard instrumentation
ModBus Thermostat / Embedded Controller
Customer Control Engine
User Security
Scheduling
Data / History
Alarm Management
ModBus TCP
I/O Modules with 8 In 8 Out 8 In 13 Out 32 In
Conventional Instrumentation
1,400 FT / 427 m
700 FT / 213 m
Veris Meters H 8036
Digital Inputs from conventional devices
30 K Ohm Thermistor Sensors
Schneider Meters E5600 / ION 8600 / PM9 / PM710 / ION 6200 / PM750
Your preferred Meter Here
Digital Outputs to conventional devices

- Mesh Architecture is Star-Mesh-PAN Coordinator
- IEEE 802.15.4 ISM Band 2.4 GHz
- 75 Full Function Nodes (Standard Architecture / Custom for OEM)
- 150 Reduced Function Nodes (Standard Architecture / Custom for OEM)
- Multiple Networks can operate in the same geography
- FFD's can Support Characterized 3rd Party Modbus RTU RS485 Slave Devices
- FFD's and RFD's can support custom Embedded Applications
- OEM Architectures
- 3rd Party Devices with Proprietary Protocols can also be "Characterized"
- All Radio Nodes on the Mesh can be Re-flashed/upgraded over the Mesh

Definitions

802.15.4

This is the IEEE Standard which governs the ISM Band devices and operating characteristics, that include total Bandwidth, Transmission Intervals and Power levels of the various devices. 802.15.4 is similar to 802.11 (WiFi) in that the Frequency Spectrum is the same, 2.4 GHz with 16 Channels. One major difference is that the total 802.15.4 Network Bandwidth is limited to 250 kbps.

PAN

Private Area Network meaning a radio network other than a Local Area Network (LAN) or Wide Area Network (WAN)

ISM

Instrument / Scientific / Medical band is the term generally used for license-free radio bands used worldwide by commonly-used radio equipment in these sectors. The 2.4GHz ISM band is the band used by most devices manufactured conforming to the IEEE 802.15.4 radio Standard.

PAN Coordinator

This is the Private Area Network Coordinator which discovers and continuously manages the Network Devices. Referred to in this document also as the wireless gateway.

FFD

The FFD or Full Function Device can operate as both an I/O device and a network Router /Repeater and is a key device in the Mesh Network architecture. Usually line-powered as they have to stay on all the time.

RFD

The RFD or Reduced Function Device only handles I/O and does not route signals from other devices. It is therefore dependent upon the FFD's to broadcast and receive communications over the Mesh Network. Most often battery-powered and uses sleep-mode to conserve power. Sleep-mode operation is a key feature designed into the 802.15.4 standard

Transmit Sensitivity

The power level at which an individual radio Node transmits.

Receive Sensitivity

The functional efficiency of the radio Node at receiving transmissions.

Planning

This section of the manual should be thoroughly read and understood as it is the most important factor in terms of assuring a successful deployment of the ECOMM products.

There are many examples and metrics which can be applied in a common sense approach to engineering your wireless application in the real world.

The fact is that the major consideration for employing Wireless Mesh technology in Automation and Control applications is to reduce cost. A secondary reason is to reduce deployment time, which also reduces cost.

The ECOMM products detailed in this manual have been in continuous production since 2005. There are hundreds of thousands of devices operating in a multitude of different applications and environments.

The single most common reason for difficulties encountered in deploying any radio products is exceeding the various devices' effective range. The following pages show what those limitations are. The metrics are not absolute, primarily due to the tremendous numbers of physical variations that can be encountered in any site.

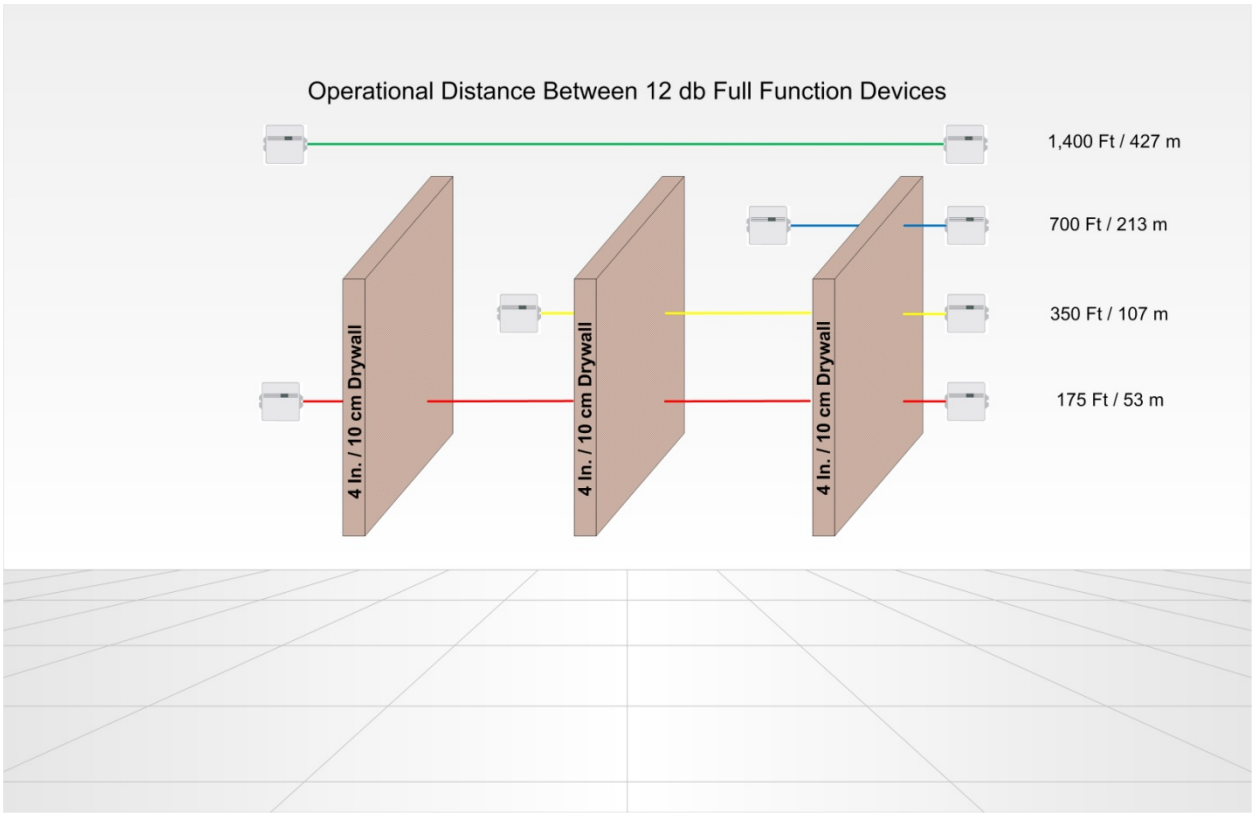
Those barriers to radio communication are common elements of consideration that every potential site will have. Distance, walls, floors, organic material, and other radio systems, to name the most common.

Distance

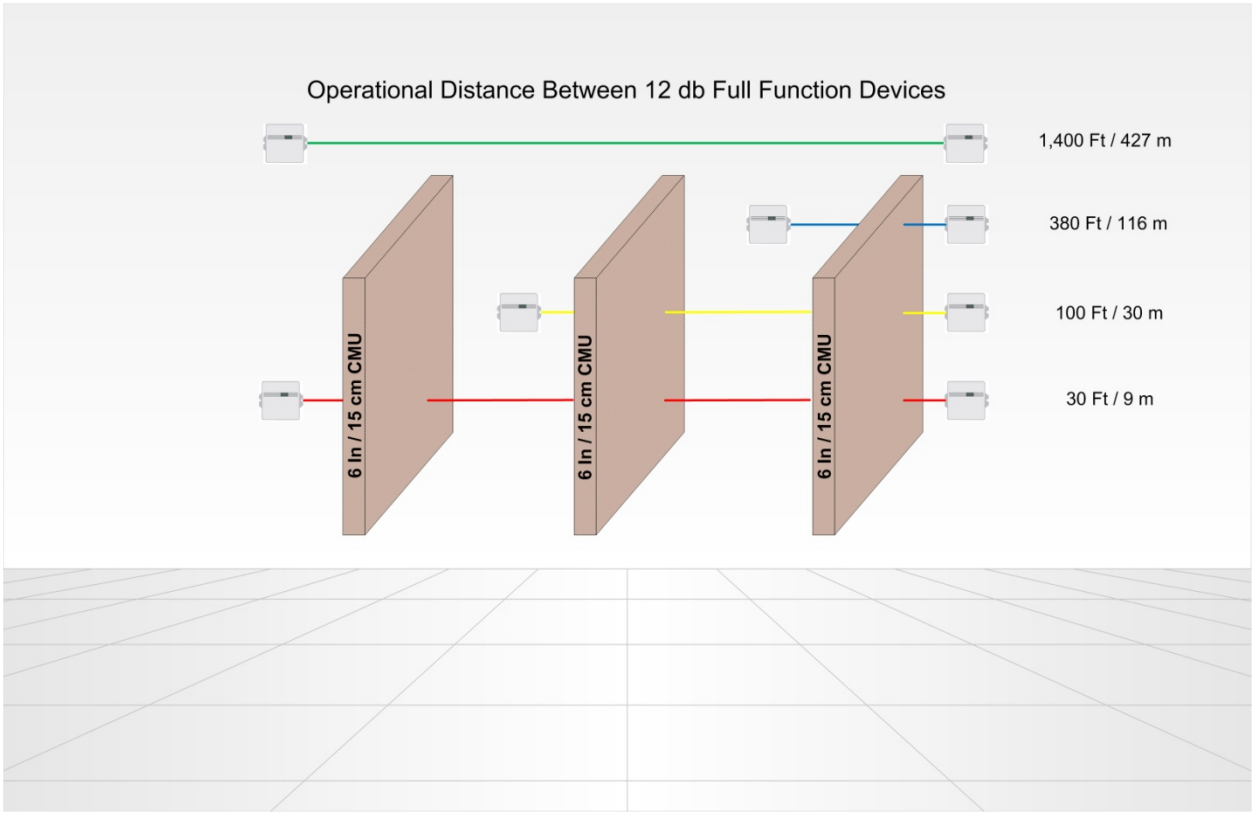
Line of sight distance is a metric that all radio product manufacturers will cite as a performance metric. It is easy to qualify that metric when there are no obstacles between the two measured points and it is extremely consistent. How many times have you been talking on your mobile phone while driving in a car with 4 bars on the communication signal strength icon when simply moving another hundred metres down the road makes the signal strength go to zero bars.

The distance metric in open air with line-of-sight conditions between the ECOMM FFD's and/or PAN Coordinator is 427 metres (1,400 ft). Move the Nodes to 442 metres (1,450 ft) apart and the communication link is gone between those two Nodes. If any two Nodes have an obstacle between them the 427 metres operational distance will be reduced by a factor. The factor is variable depending upon the type of material the obstacle is constructed from and the thickness and density of that material.

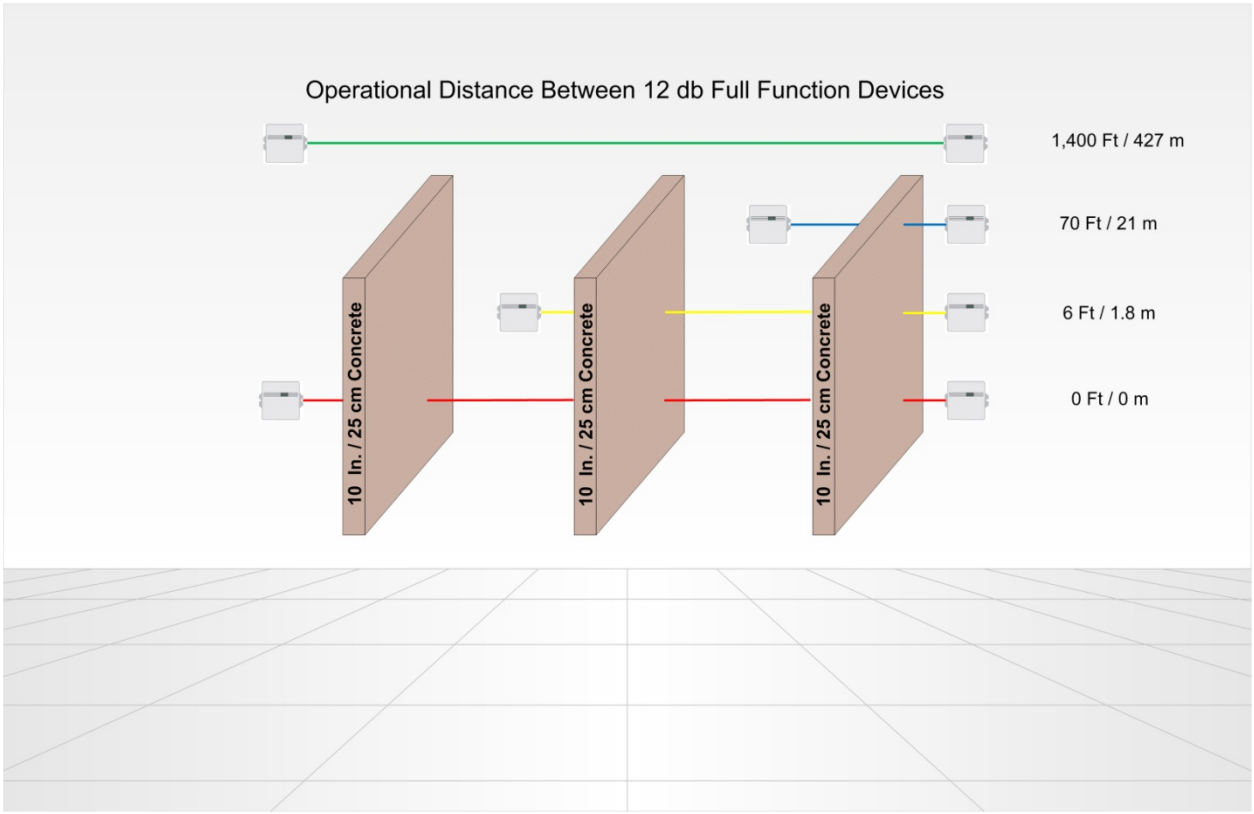
A common material encountered would be 10 cm (4") interior construction plasterboard stud partition. In this case each wall between the FFD's reduces the effective operational distance by 50% but still provides useful range in a building context.


Operational Distance Between 12 db Full Function Devices
1,400 Ft / 427 m
700 Ft / 213 m
350 Ft / 107 m
175 Ft / 53 m
4 In. / 10 cm Drywall
4 In. / 10 cm Drywall
4 In. / 10 cm Drywall

Another common material encountered would be cinder/thermalite block walls. The metrics on this material are shown below. The per obstacle signal strength loss here is far more significant, about 75% but still provides useful range in a building context.

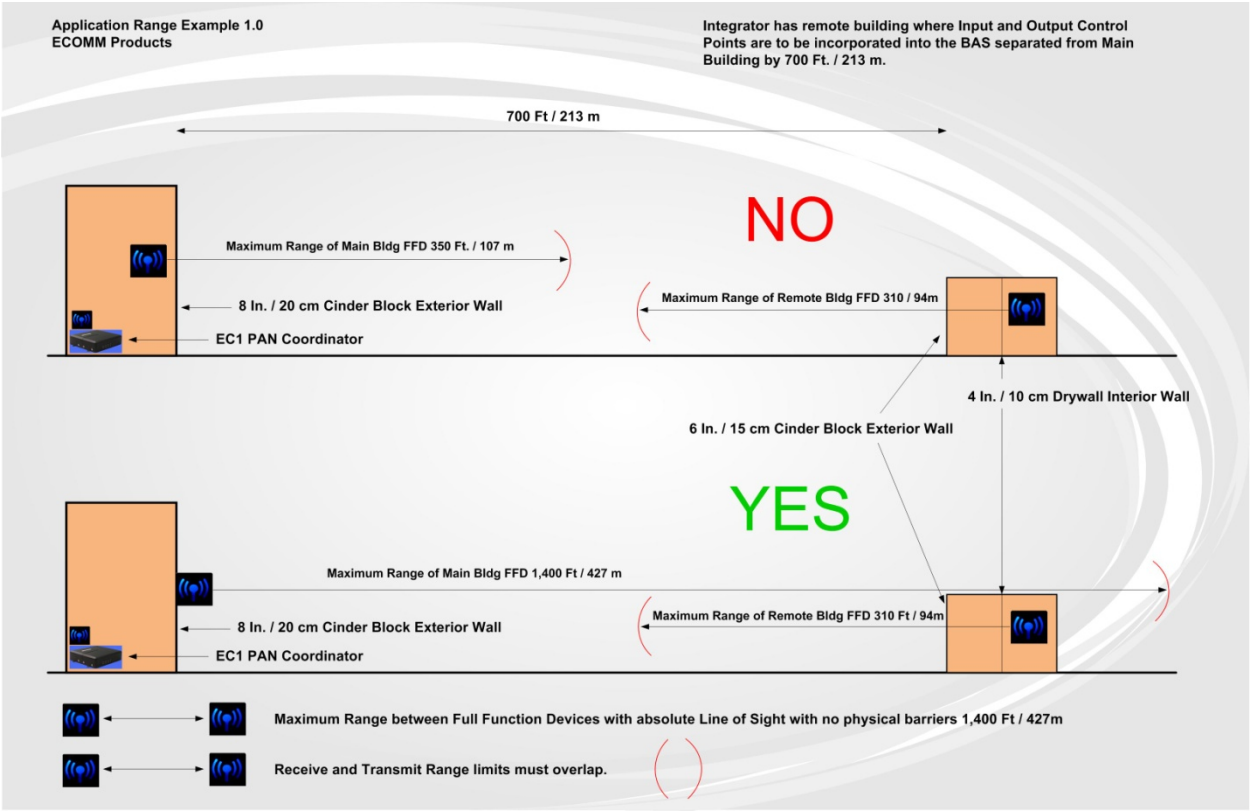

Operational Distance Between 12 db Full Function Devices
1,400 Ft / 427 m
380 Ft / 116 m
100 Ft / 30 m
30 Ft / 9 m
6 In / 15 cm CMU
6 In / 15 cm CMU
6 In / 15 cm CMU

Another common material for walls and floors is concrete. Many central plant machine rooms and other areas in lower floors of high-rise structures have load bearing concrete walls of varying thicknesses and densities.


Operational Distance Between 12 db Full Function Devices
1,400 Ft / 427 m
70 Ft / 21 m
6 Ft / 1.8 m
0 Ft / 0 m
10 In. / 25 cm Concrete
10 In. / 25 cm Concrete
10 In. / 25 cm Concrete

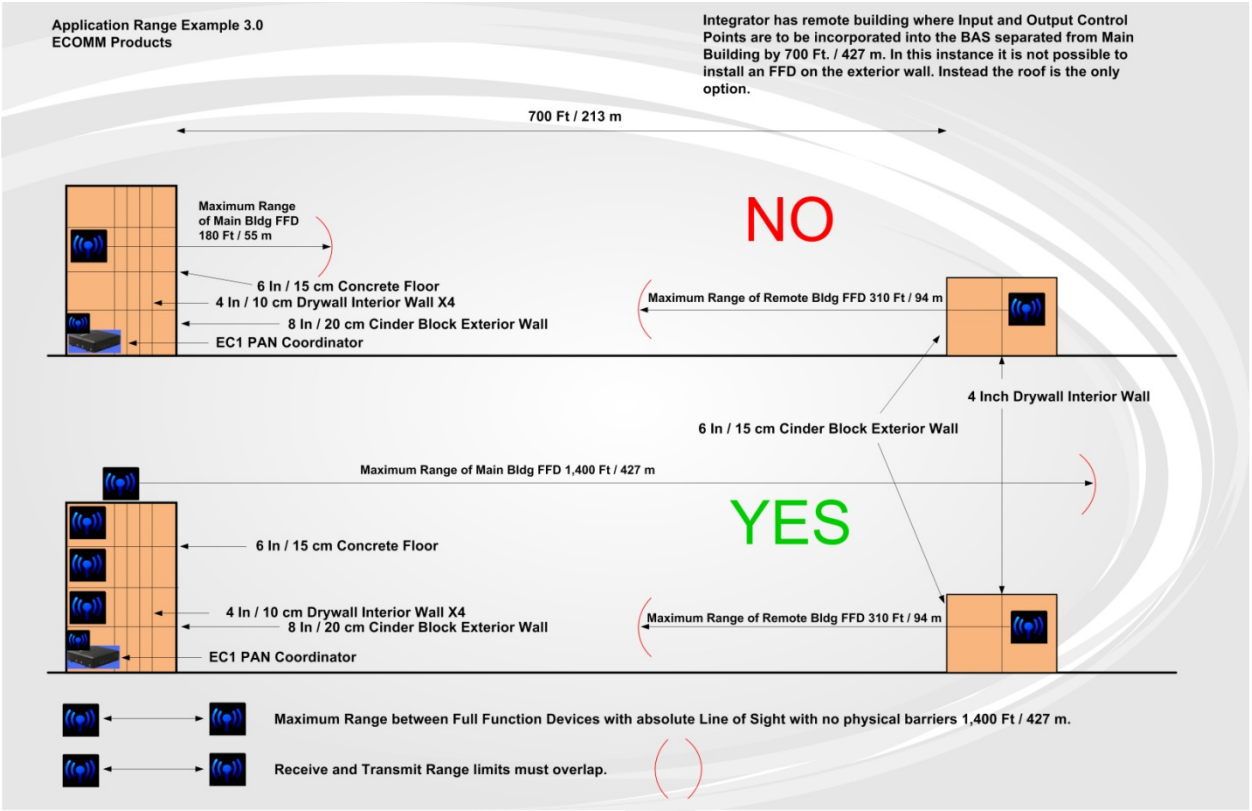
Often the most advantageous location to place the wireless gateway would seem to be adjacent to the automation system panel, which often may be located in a central plant environment or equivalent. In reality a far better location from a radio mesh perspective might be a hallway ceiling 15 metres (50 ft) horizontally distant from the automation panel, thus eliminating 1 or 2 concrete walls as obstacles. Yes, it will cost the installer a bit more conduit and CAT 5 cable than was originally planned for, but it will eliminate possibly many hours of frustrating radio network troubleshooting where the possible eventual remedy will be to move the wireless gateway to that location anyway.

Applications for mesh networks where the radio signal goes from indoor to outdoor locations are very common. Here are some simple Do’s and Don’ts.


Application Range Example 1.0
ECOMM Products
Integrator has remote building where Input and Output Control Points are to be incorporated into the BAS separated from Main Building by 700 Ft. / 213 m.
700 Ft / 213 m
NO
Maximum Range of Main Bldg FFD 350 Ft. / 107 m
8 In. / 20 cm Cinder Block Exterior Wall
EC1 PAN Coordinator
Maximum Range of Remote Bldg FFD 310 / 94m
4 In. / 10 cm Drywall Interior Wall
6 In. / 15 cm Cinder Block Exterior Wall
YES
Maximum Range of Main Bldg FFD 1,400 Ft / 427 m
8 In. / 20 cm Cinder Block Exterior Wall
EC1 PAN Coordinator
Maximum Range of Remote Bldg FFD 310 Ft / 94m
Maximum Range between Full Function Devices with absolute Line of Sight with no physical barriers 1,400 Ft / 427m
Receive and Transmit Range limits must overlap.

In this example by locating the FFD on the outside wall of the main building as opposed to leaving it inside, the 200mm cinder/thermalite block wall was eliminated as a radio transmission barrier giving the FFD a broadcast range of 427 metres vs. the 107 metres it would have if it were inside the building. Yes, the cost of an IP66 enclosure and drilling a hole through the wall for power wiring was perhaps not contemplated, but it would most likely be less expensive than trenching 213 metres for underground communication cable.

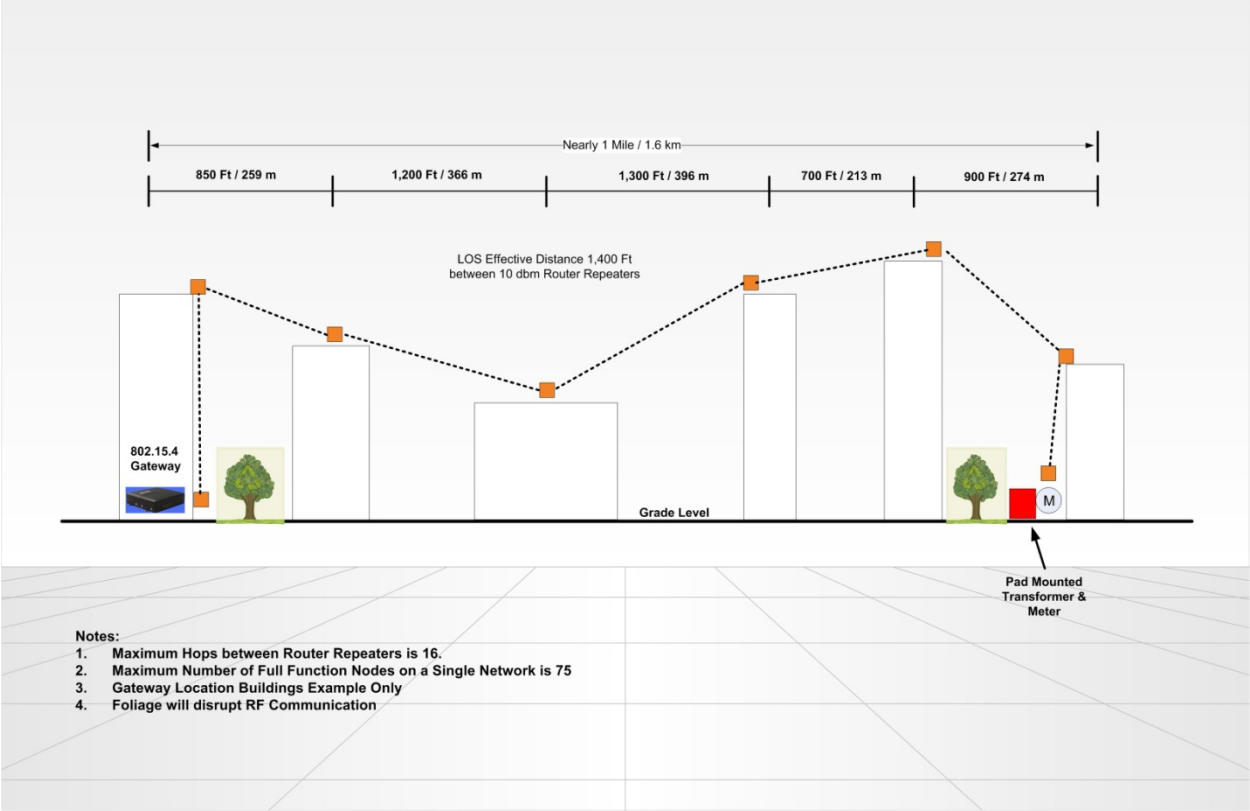
When vertical and horizontal barriers are both brought into the equation another set of considerations is necessary. Concrete is the predominant material encountered for floor construction in many structures. Using the same application example this is a likely architecture that would be needed.


Application Range Example 3.0
ECOMM Products
Integrator has remote building where Input and Output Control Points are to be incorporated into the BAS separated from Main Building by 700 Ft. / 427 m. In this instance it is not possible to install an FFD on the exterior wall. Instead the roof is the only option.
700 Ft / 213 m
Maximum Range of Main Bldg FFD 180 Ft / 55 m
NO
6 In / 15 cm Concrete Floor
4 In / 10 cm Drywall Interior Wall X4
8 In / 20 cm Cinder Block Exterior Wall
EC1 PAN Coordinator
Maximum Range of Remote Bldg FFD 310 Ft / 94 m
4 Inch Drywall Interior Wall
6 In / 15 cm Cinder Block Exterior Wall
Maximum Range of Main Bldg FFD 1,400 Ft / 427 m
YES
6 In / 15 cm Concrete Floor
4 In / 10 cm Drywall Interior Wall X4
8 In / 20 cm Cinder Block Exterior Wall
EC1 PAN Coordinator
Maximum Range of Remote Bldg FFD 310 Ft / 94 m
Maximum Range between Full Function Devices with absolute Line of Sight with no physical barriers 1,400 Ft / 427 m.
Receive and Transmit Range limits must overlap.

Based on the possibility the owner of the building would not want the IP66 enclosure on the exterior wall of the building it must be placed on the roof with the wireless transmission reaching it through the floors. So the requirement would be for an FFD on each of the 2nd, 3rd and 4th floors as well as the roof of the main building..

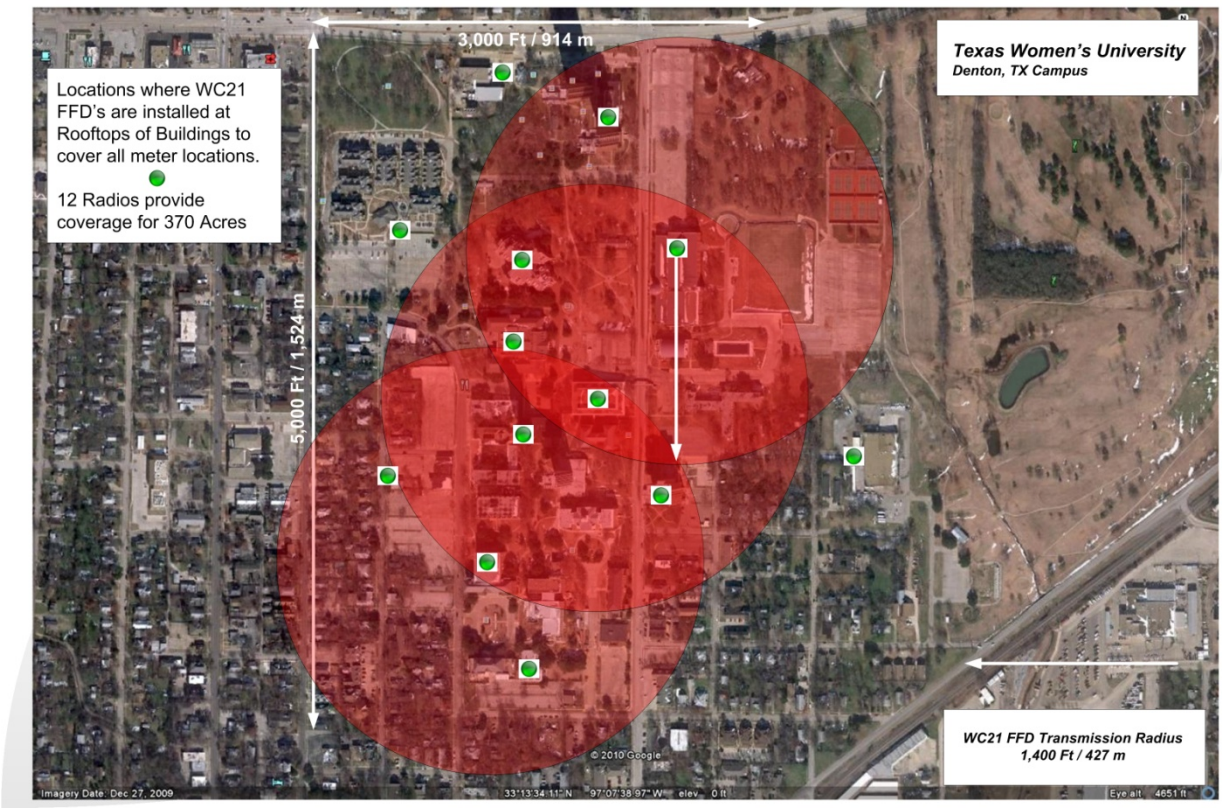
Large Geographies

Let us assume that your application involves adding control or monitoring points on a campus. This may involve many buildings but just a few points to be monitored in each, possibly including metering applications. Without having to put a gateway in each building with just a single FFD on each network what is the best way to extend the wireless mesh network over a large campus?


Nearly 1 Mile / 1.6 km
850 Ft / 259 m
1,200 Ft / 366 m
1,300 Ft / 396 m
700 Ft / 213 m
900 Ft / 274 m
LOS Effective Distance 1,400 Ft
between 10 dbm Router Repeaters
802.15.4
Gateway
Grade Level
M
Pad Mounted
Transformer &
Meter
Notes:
1. Maximum Hops between Router Repeaters is 16.
2. Maximum Number of Full Function Nodes on a Single Network is 75
3. Gateway Location Buildings Example Only
4. Foliage will disrupt RF Communication

To extend the range of the network without having to contend with the obstacles each building represents one solution is to install an ‘upper layer’ of the mesh network FFD’s at the roofs of the taller buildings. On this campus example you would now have a network of FFD’s with down-looking signal radiation patterns and you would have extended the mesh network almost 1.6 km (1 mile) from the gateway. Excluding the last hop to any end device on the mesh and using the maximum number of hops permitted in the mesh itself, in ideal conditions the mesh network can effectively be extended over a radius of almost 6.4 km (4 miles) from the gateway.

Looking at the same geography from above the network coverage area would look something like this.


3,000 Ft / 914 m
5,000 Ft / 1,524 m
Locations where WC21 FFD's are installed at Rooftops of Buildings to cover all meter locations.
12 Radios provide coverage for 370 Acres
Texas Women's University
Denton, TX Campus
WC21 FFD Transmission Radius
1,400 Ft / 427 m
© 2010 Google

In this example the installer would have to spend a few days on site testing the line of sight distances and the down-looking pattern of the FFD's located at the rooftops of the various buildings to assure that the desired extension of the Mesh Network would be the end result. This is an actual installation and resulted in a reduction in installed cost of approximately £130,000 (€148,000) by not having to wire communication cable from within the various buildings to pad mounted transformers located outside the buildings.

Other radio systems

To obtain best performance, components of the ECOMM mesh network should not be installed in close proximity to the following other types of radio systems:

Indoor Mobile Phone Repeaters

Indoor mobile phone repeaters (often called ‘pico-cells’) are fairly common in some high-rise structures. While they do not operate in the same frequency band as the ECOMM products they operate at significantly higher transmit power and can create significant interference and possible long-term failure of the ECOMM products if they are within 6 metres (20 ft), of the much lower power ECOMM radios. The closer the proximity, the higher the likelihood of disruption to the ECOMM product. The mobile phone repeaters in Europe operate in the 850 MHz and 1.9 GHz bands and if they are medium power they can cause a phenomenon called “desensitisation”, which ultimately can cause saturation or cause nonlinearities that prevent the ECOMM radio from sending or receiving signals from its mesh network peers.

802.11 b/g/n Wi-Fi Wireless Routers or Access Points

These very common appliances operate in the same 2.4 GHz band as the ECOMM products and can have similar influence on the ECOMM products but are generally significantly less powerful than the mobile phone repeaters. By maintaining a separation distance of 3 metres (10 ft) from these devices any interference issues will be avoided.

Microwave Ovens

While the occurrences have been rare they can present a problem if the doors of the subject oven leak radiation from the oven transponder while it is operating. Keep in mind the power output of the ECOMM FFD radio is10 mW. The output power of a typical commercial microwave oven transponder, which operates in the 2.4 GHz frequency band is 1200 W, or 120,000 times more powerful than the ECOMM radio. So if the ECOMM WT770 thermostat that was installed in the breakfast area of a hotel ceases to communicate periodically during the hours of breakfast service you may want to inform your customer he may be putting his customers who are in proximity of the oven at a health risk.

Inductive Fields in General

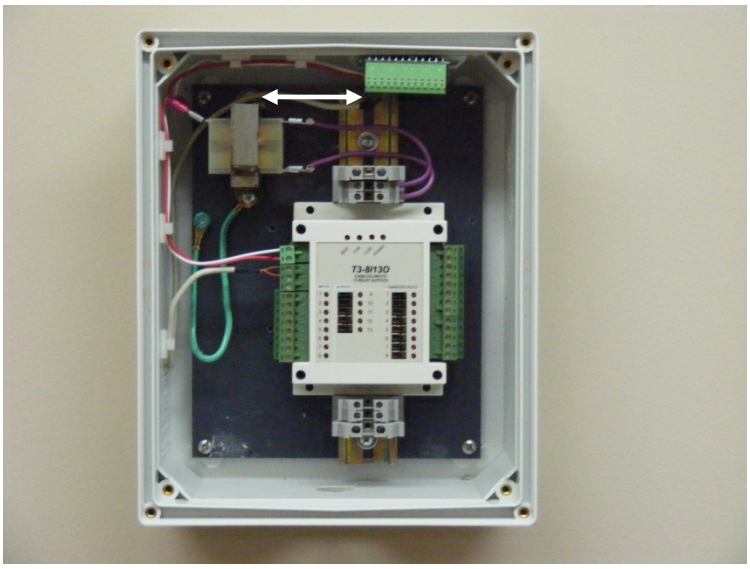
Control Power Transformers

Integrators who would use ECOMM products would naturally place the radios within enclosures that would also include other conventional devices such as control power transformers, contactors, relays etc. This is perfectly fine as long as the radios are far enough away from devices that produce inductive fields.

Listed below are some typical minimum clearances:

100 VA Transformer	12.7 cm (5”)
40 VA Transformer	8.9 cm (3.5”)
20 VA Transformer	6.4 cm (2.5”)
60 Amp Contactor	15 cm (6”)
30 Amp Contactor	8.9 cm (3.5”)
10 Amp Pilot Duty Relay	5 cm (2”)

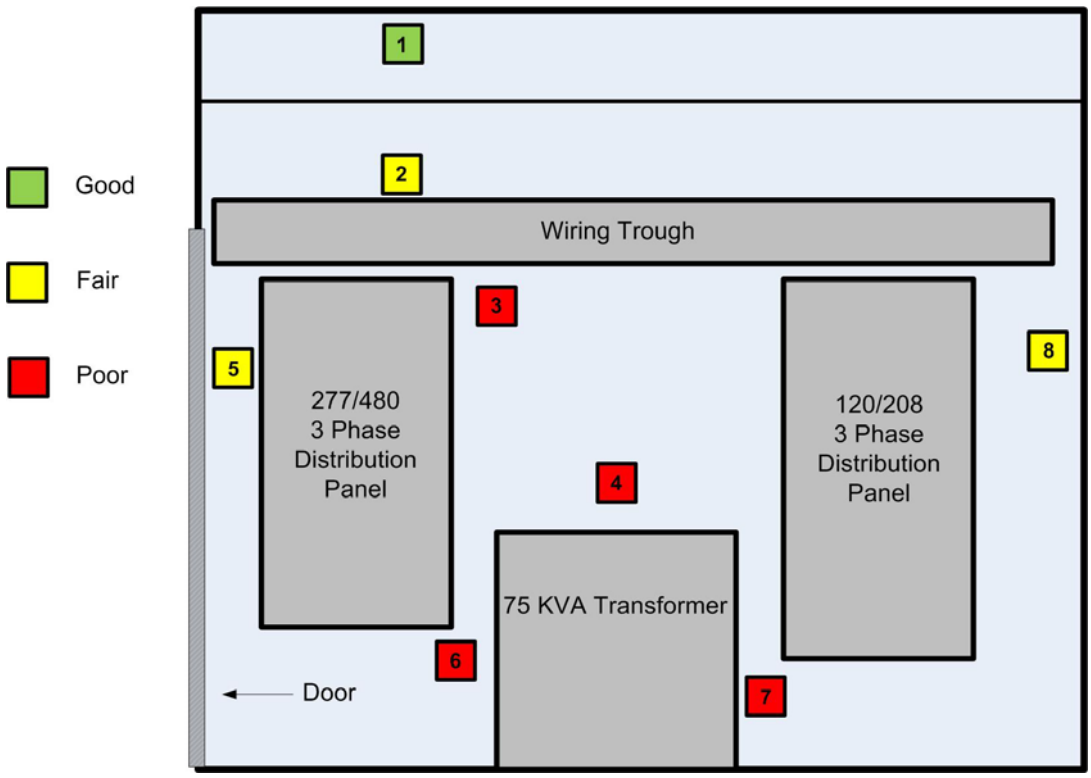
The picture below shows one of the ECOMM fabricated products WC21-813-IP66, which is an 8 Input, 13 Output Module with a 20 VA control power transformer mounted in an IP66 housing. The enclosure and mounting back plate are polycarbonate. The white line represents 6.4 cm (2.5”). The enclosure dimensions are 200x250x100mm (8”x10”x4”).



WC21-813-IP66

A common location to install ECOMM FFD products are in the utility rooms or telephone closets or mechanical rooms of floor areas. There are some basic installation methods that should be followed. Often these types of rooms are

crowded with the equipment they were designated for with very little wall space available. The drawing below shows good, fair and poor locations for the ECOMM radios.



Locations 4,6 and 7 are not only too close to a large inductive field, location 4 is also directly above a large heat generating source, even though the ECOMM FFD will operate at 63°C (145°F), inside a plastic enclosure with a control transformer the heat rise would be substantial.

Location 3 and 4 are surrounded on 4 sides by metal objects which will limit the radio transmission pattern to certain areas. A metal plate can cause a partial ‘radio shadow’ behind it if you visualise the radio waves travelling in straight lines from the transmitter.

Locations, 5 and 8 are satisfactory in that the ECOMM radio only has metal obstacles on 2 sides. Location 2 is better with metal obstacle only on 1 side.

Location 1 is most ideal. Widest possible transmission spectrum from this location.

Other radio Transmission Barriers

Radio transmissions at the power and frequency of the ECOMM products will have significantly reduced propagation through solid metal, water, and organic materials which contain water.

Examples of organic materials that contain water are leaves of trees, large piles of harvested fruits and vegetables, and human bodies.

Metal

The wavelength of the 2.4 GHz sinusoidal waveform is a little over 25mm (1”) top to bottom and will pass through openings of that size in virtually any orientation. As an example test, take the EC1 gateway and temporarily install it in an IP30 metal enclosure with a hinged door. Add an FFD to the network outside the enclosure at a physical distance of less than 3 metres (10ft) away from the enclosure. Compare the signal strengths of the FFD to the EC1 with the door opened and closed. Open the signal strength should be in the range of -35 dBm. Closed it will be in the range of -88 dBm. In this case the radio signal is getting out of the metal enclosure through the gaps between the door and the body of the enclosure, but the radiation pattern is extremely narrow. Move the FFD to a distance of 9 metres (30ft) away from the enclosed EC1 and the signal will likely be lost at -94 dBm.

Plaster or Stucco Walls (not so common in Europe)

While not metal in totality the lath material in either of these types of walls can be a problem. In more modern construction methods both metal and plastic laths are used. In older buildings metal laths is most common, in some cases wood lath.

Metal lath is the most difficult because the opening pattern of the lath is typically smaller than the 2.4 GHz wavelength. This lath acts precisely like the metal mesh screen in the window of your microwave oven, and it prevents the high power 2.4 GHz 1,200 Watt signal from escaping while still allowing you to look at the contents being heated..

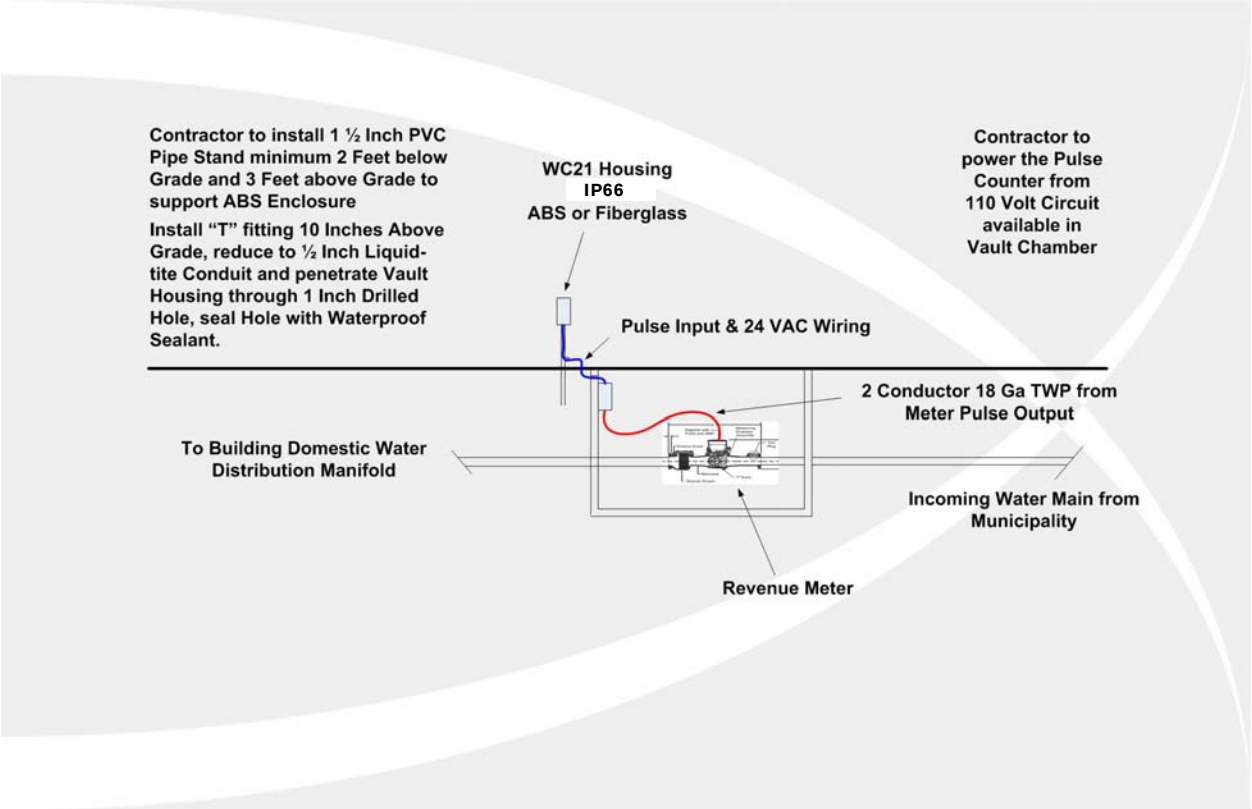
The ECOMM 2.4 GHz radio signal will however penetrate many areas along the entire wall where the lath does not form a perfect radio barrier. These would be next to recessed sockets and gang boxes, along the edges of the walls, floors and ceilings where the lath is typically cut and installed with less than surgical precision.

Organic Material

Several users of ECOMM products have encountered difficulties with mesh radio communications in applications that involve outdoor installations where there are a lot of natural vegetation especially tall deciduous trees and shrubs which have no leaves for much of the year. One such case involved a user who installed the devices in February, and in May, three months later they ceased working.

When questioned about the geography of the application it was discovered that there was a row of trees between the two radio locations that did not have any leaves on them in February but were in full bloom in May.

Water, in the form of built up snow or ice will not allow satisfactory radio transmission in the 2.4 GHz frequency range. If installing a WC21 as a pulse counter on an underground tank water meter the installation should look something like this.


Contractor to install 1 ½ Inch PVC Pipe Stand minimum 2 Feet below Grade and 3 Feet above Grade to support ABS Enclosure
Install "T" fitting 10 Inches Above Grade, reduce to ½ Inch Liquid-tite Conduit and penetrate Vault Housing through 1 Inch Drilled Hole, seal Hole with Waterproof Sealant.
WC21 Housing
IP66
ABS or Fiberglass
Contractor to power the Pulse Counter from 110 Volt Circuit available in Vault Chamber
Pulse Input & 24 VAC Wiring
2 Conductor 18 Ga TWP from Meter Pulse Output
To Building Domestic Water Distribution Manifold
Incoming Water Main from Municipality
Revenue Meter

The principal consideration here is the radio penetration of the manhole cover which will probably be metal or metal-backed concrete and, in some geographical areas, potential for snow build up. The height of the WC21 above ground would depend upon the likely maximum depth of snow but 1 metre (3ft) should be a working minimum.

Wireless Geography

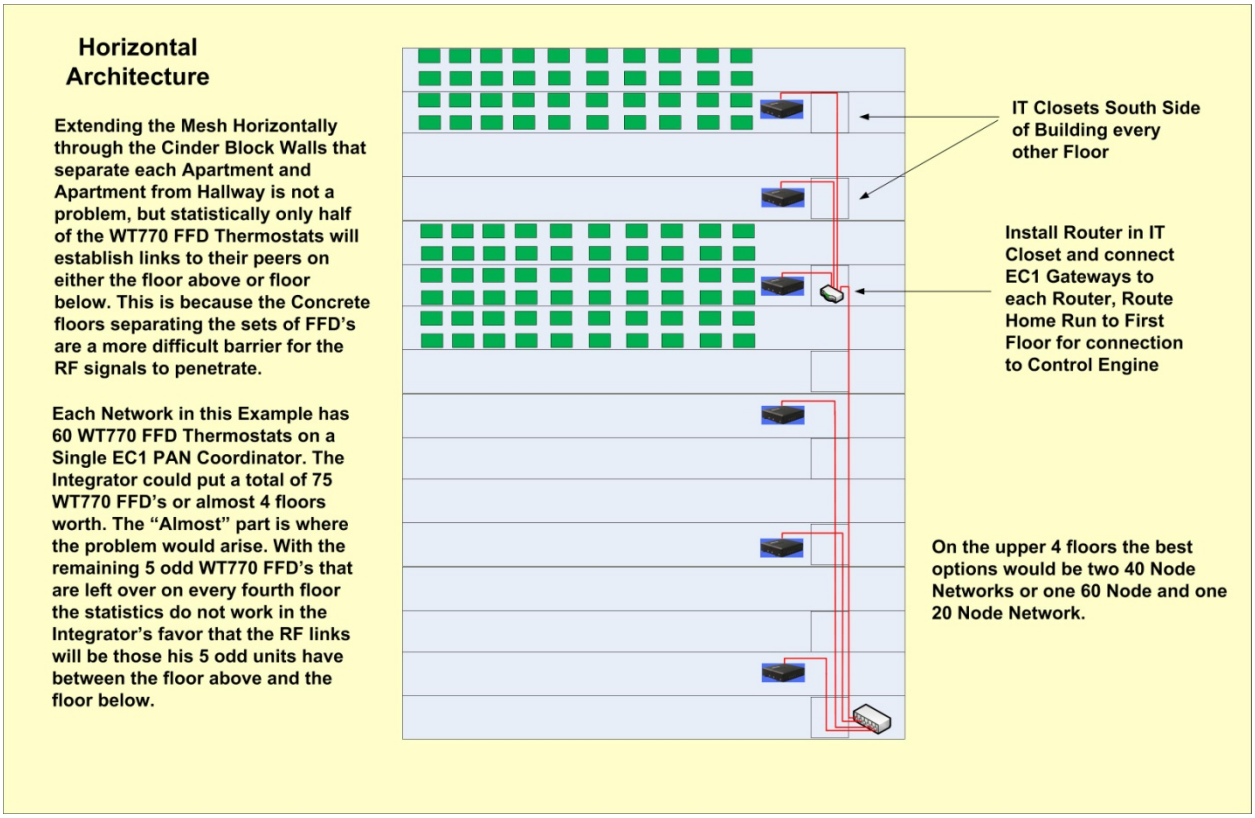
The perfect mesh radio environment in terms of physical geography would be a spherical shape. Not many buildings have that type of architecture.

We generally deal with rectangular or square cuboids in an unlimited number of potential configurations.

In the mesh radio environment we contend mainly with horizontal and vertical physical geographies. Horizontal is generally easier to deal with, vertical, generally requires more planning although in a multi-floor installation it is not always possible from a human perspective to predict which devices will connect with each other most easily.

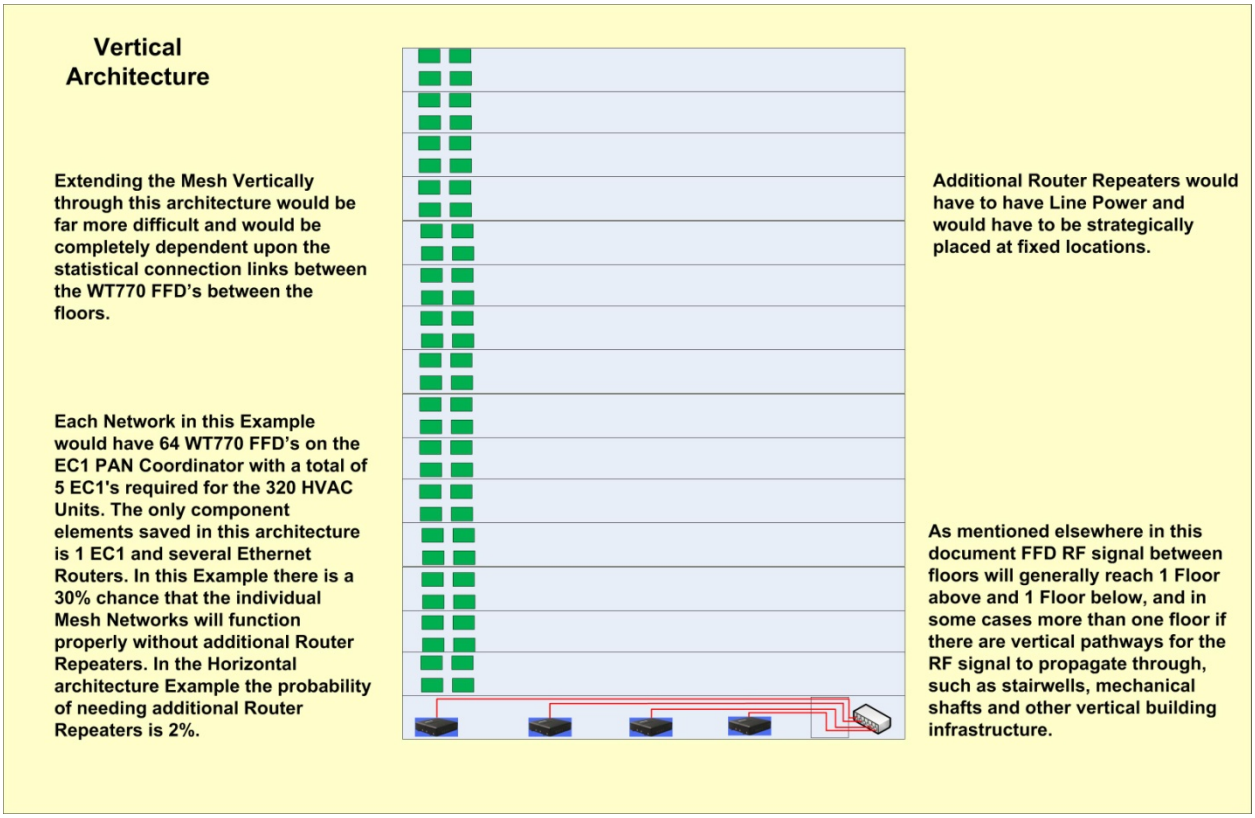
The example we will cover is a 16 floor apartment building or block of flats. Each individual apartment/flat has its own HVAC unit in the form of a water source heat pump, and there are 20 Individual units per floor. The Integrator intends to replace the existing thermostats with the WT770 FFD and network the thermostats back to a control system that allows various user/owner functions to take place.

Horizontal Topography with the Mesh


Horizontal Architecture
Extending the Mesh Horizontally through the Cinder Block Walls that separate each Apartment and Apartment from Hallway is not a problem, but statistically only half of the WT770 FFD Thermostats will establish links to their peers on either the floor above or floor below. This is because the Concrete floors separating the sets of FFD's are a more difficult barrier for the RF signals to penetrate.
Each Network in this Example has 60 WT770 FFD Thermostats on a Single EC1 PAN Coordinator. The Integrator could put a total of 75 WT770 FFD's or almost 4 floors worth. The "Almost" part is where the problem would arise. With the remaining 5 odd WT770 FFD's that are left over on every fourth floor the statistics do not work in the Integrator's favor that the RF links will be those his 5 odd units have between the floor above and the floor below.
IT Closets South Side of Building every other Floor
Install Router in IT Closet and connect EC1 Gateways to each Router, Route Home Run to First Floor for connection to Control Engine
On the upper 4 floors the best options would be two 40 Node Networks or one 60 Node and one 20 Node Network.

In this example with 320 WT770 FFD Thermostats, if all of the Thermostats were powered up and placed into operation before any of the EC1 wireless gateways were installed the first EC1 could potentially discover all of the FFD's, or at least a significant number of them. The Integrator would have to de-select devices that he did not want on the individual EC1's Network.

Vertical Topography with the Mesh

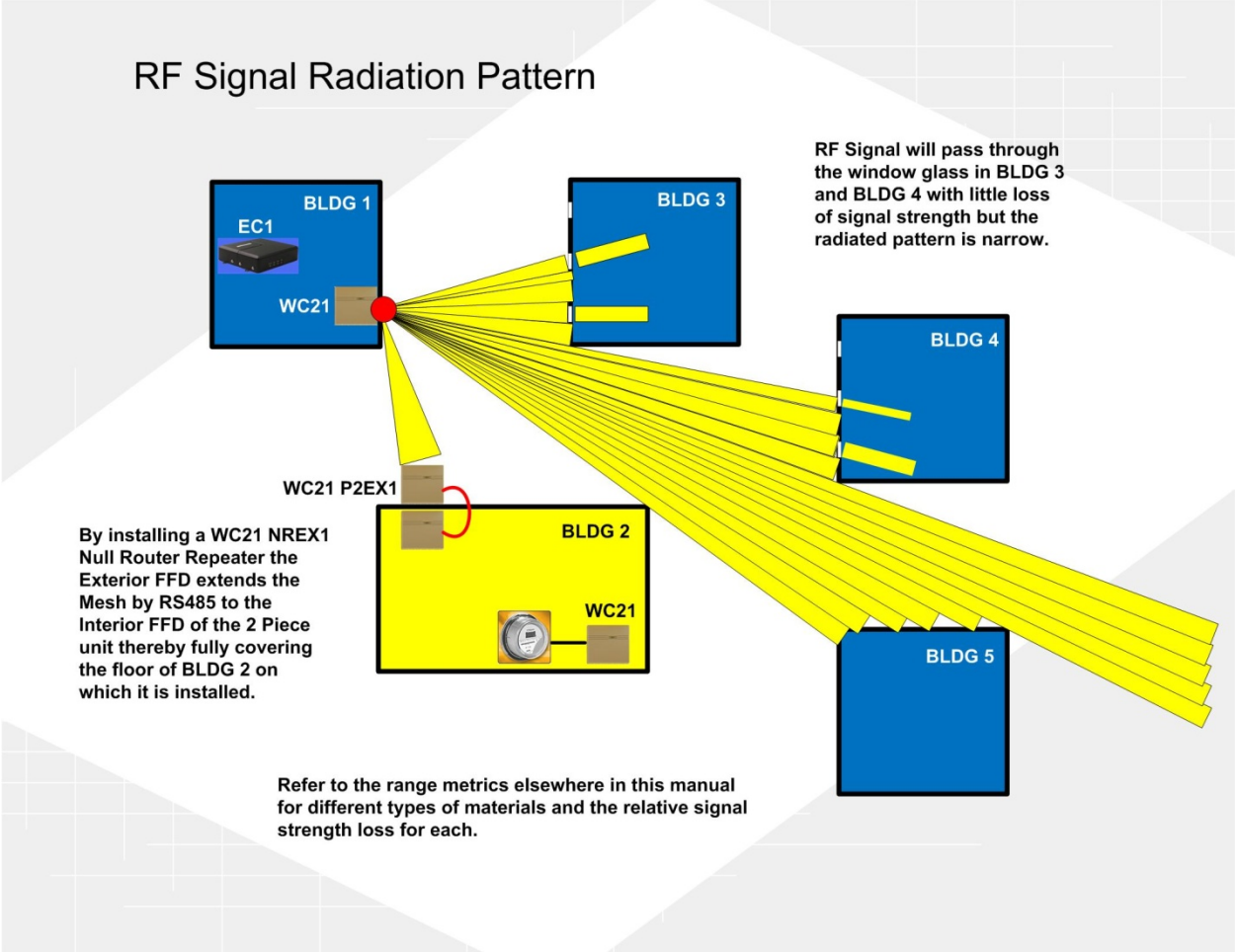

Vertical Architecture
Extending the Mesh Vertically through this architecture would be far more difficult and would be completely dependent upon the statistical connection links between the WT770 FFD's between the floors.
Each Network in this Example would have 64 WT770 FFD's on the EC1 PAN Coordinator with a total of 5 EC1's required for the 320 HVAC Units. The only component elements saved in this architecture is 1 EC1 and several Ethernet Routers. In this Example there is a 30% chance that the individual Mesh Networks will function properly without additional Router Repeaters. In the Horizontal architecture Example the probability of needing additional Router Repeaters is 2%.
Additional Router Repeaters would have to have Line Power and would have to be strategically placed at fixed locations.
As mentioned elsewhere in this document FFD RF signal between floors will generally reach 1 Floor above and 1 Floor below, and in some cases more than one floor if there are vertical pathways for the RF signal to propagate through, such as stairwells, mechanical shafts and other vertical building infrastructure.

The best approach is the Horizontal method and only slightly more costly from a hardware perspective. Furthermore, in this retrofit application the likelihood is that an entire floor's devices would be installed at one time, and thus every three floors installed the Integrator could then complete the Network start up for that group.

In the most ideal environment you want to locate the wireless gateway as close to the geographic centre of the mesh network as is possible. This greatly expands the reliability of the mesh network as it increases the number of FFD's that will be directly connected to the gateway and in the horizontal approach vastly reduces the required number of hops between FFD's.

Radio Radiation Pattern

Working between the constraints of distance and obstacles, placement of the FFD mesh nodes becomes a very important factor. In the example below we examine the radio transmission paths of a mesh network between several small buildings in a relatively small geography. The exterior walls of buildings 2, 3, 4 and 5 are made of 400mm (16”) sandstone blocks and are virtually impenetrable by 2.4 GHz radio transmission.


RF Signal Radiation Pattern
RF Signal will pass through the window glass in BLDG 3 and BLDG 4 with little loss of signal strength but the radiated pattern is narrow.
BLDG 1
EC1
WC21
BLDG 3
BLDG 4
WC21 P2EX1
BLDG 2
WC21
BLDG 5
By installing a WC21 NREX1 Null Router Repeater the Exterior FFD extends the Mesh by RS485 to the Interior FFD of the 2 Piece unit thereby fully covering the floor of BLDG 2 on which it is installed.
Refer to the range metrics elsewhere in this manual for different types of materials and the relative signal strength loss for each.

Configuration

Device Types

PAN Coordinator (EC1 / EC1A / EC3)

The PAN Coordinator is the wireless network manager. It is used to discover the other devices and is the gateway to and from the control engine or data collection engine of the end user. It is also used for configuring all of the tertiary network devices, both FFD's and RFD's. PAN Coordinator is the primary device, mesh routers are the secondary devices, sensing/control devices with I/O are the tertiary devices.

The data flow over the wireless network is a, "push" mode from the various tertiary wireless devices up to the PAN Coordinator.

FFD Full Function Device (WC21 / WC21S / WC21-88 / WC21-813 / WC21-32 / WC21-P2 / WC21-NR / WC21-LC / WT770)

The WC stands for Wireless Controller, the 2 for Generation and the 1 for Version.

This unit is the workhorse of the ECOMM wireless mesh network. The principal role of the WC21 FFD in the mesh network is as a router/repeater. In addition to whatever mode the WC21 FFD may be used for it is above all else a router/repeater.

All of the WC21 modes require continuous line power. They can be powered with either 24 VAC 50/60 Hz, or 12 VDC. The WT770 operates only on 24 VAC 50/60 Hz.

The WC21 series also support wireless connections to RFD's. The FFD's communicate amongst themselves and the RFD's that they are associated with, and also with the PAN Coordinator.

RFD Reduced Function Device (WO11 / WO12 / WO12A / WO23 / WT11 / WT21 / WT22)

The RFD's are battery powered devices that do not function as a router/repeater. They must have an association with an FFD. They cannot communicate with the PAN Coordinator directly. In the standard ECOMM architecture each FFD can support between 2 and 16 RFD's depending on type and reporting interval.

In the network the RFD's push their data to the FFD's which in turn push the data from the RFD's that they are associated with along with their own data to the PAN Coordinator.

Each device, either FFD or RFD can have a unique reporting interval. At the chosen interval all data registers that have a change of value since the previous reporting interval will be pushed to the PAN Coordinator.

Output instructions to the PAN Coordinator that originate from the end user control engine get sent to the target mesh node device instantaneously, with the only delay being the 50 ms per hop over the mesh network plus the processing time at the PAN Coordinator of nominally 500 ms. So if the instruction had to make 10 hops over the Mesh Network the time from the PAN Coordinator receiving the output instruction to the action being taken at the end device would be 1 second. This does not include the time for retries for packet failure, which is totally dependent on the robustness of the mesh.

FFD reporting intervals are configurable in 1 second Increments between 10 and 3,600 Seconds.

RFD reporting intervals are configurable in 8 second Increments between 8 and 3,600 Seconds.

Example: If a WC21-813 had a reporting interval of 60 seconds and received an output instruction over the mesh network to turn on output 4 digital relay at the 29 second mark of its current report interval that action would occur instantly. The status change from output 4 off, to output 4 on, would not be received at the PAN Coordinator for the balance of the current reporting interval, or 31 seconds later.

Configuring the ECOMM Network

The **EC1 PAN Coordinator** configures and connects ECOMM wireless devices to open-protocol automation systems and business applications. The device consists of a radio module with integrated antenna and a Linux-based embedded gateway. See the EC1 specification sheet for more details.

The inputs and outputs of wireless mesh devices are dependent on device type and are automatically mapped to Modbus registers and can be accessed using Modbus TCP; Modbus registers have been pre-assigned to indicate link status and sensor battery condition (if applicable).

The mesh gateway can support up to 75 FFD's plus 150 RFD's. The self-forming mesh network is easy to start-up and the self-healing feature provides outstanding robustness, data throughput and communication availability. The EC1 Modbus mesh gateway provides a browser-based remote configuration and maintenance over IP, and the unique benefit of over-the-air software/firmware upgradability.

The EC1 factory default mode and IP address are DHCP, 192.168.11.1. Performing a "hard reset" will return the EC1 to these settings.

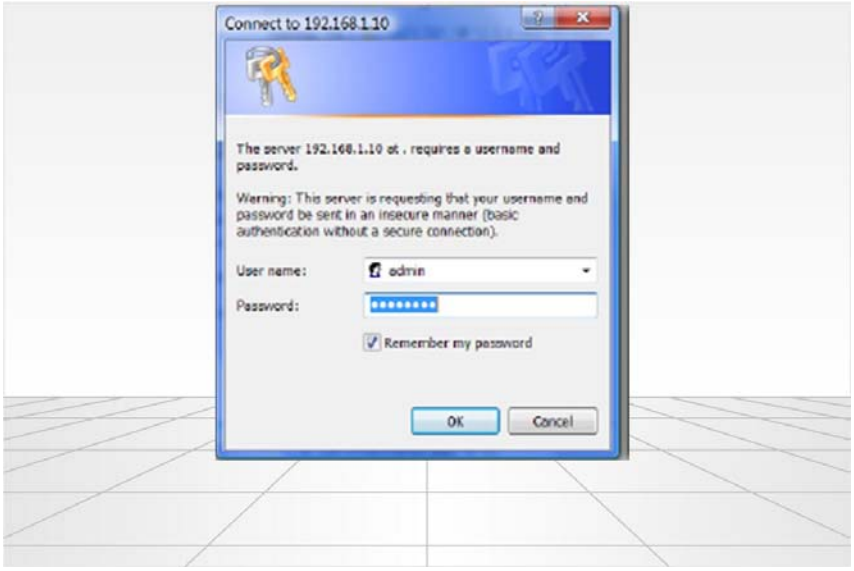
Start Up Method

As a general rule all or as many of the FFD's on the network should be installed and powered up prior to powering up the EC1 PAN Coordinator. When the WC21 radio is powered up without the PAN Coordinator being powered, the LED on the WC21 will flash on and off 3 times per second. In this mode it is looking for a PAN Coordinator in its 'discovery' mode.

None of the RFD's should be powered up at this time. See Page 36 for a more detailed explanation.

There is no external software needed to access the EC1, the user interface (UI) is an embedded application on the EC1, you need only have a web browser on your PC or laptop.

When you first access the UI of the EC1 you will be presented with a Login Screen.


Connect to 192.168.1.10
The server 192.168.1.10 at . requires a username and password.
Warning: This server is requesting that your username and password be sent in an insecure manner (basic authentication without a secure connection).
User name:
admin
Password:
Remember my password
OK
Cancel

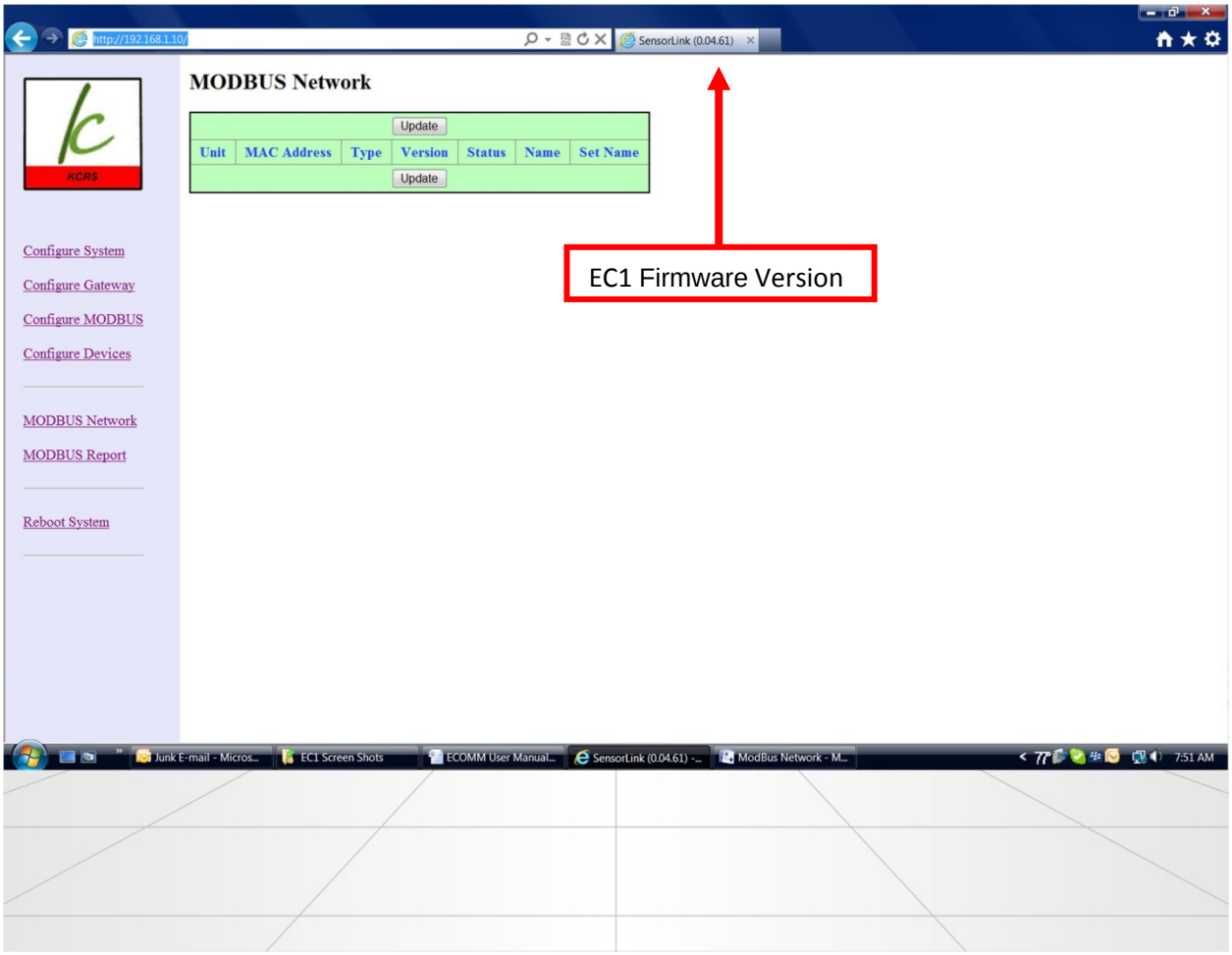
Default Credentials:

User Name = admin

Password = password

Home Page

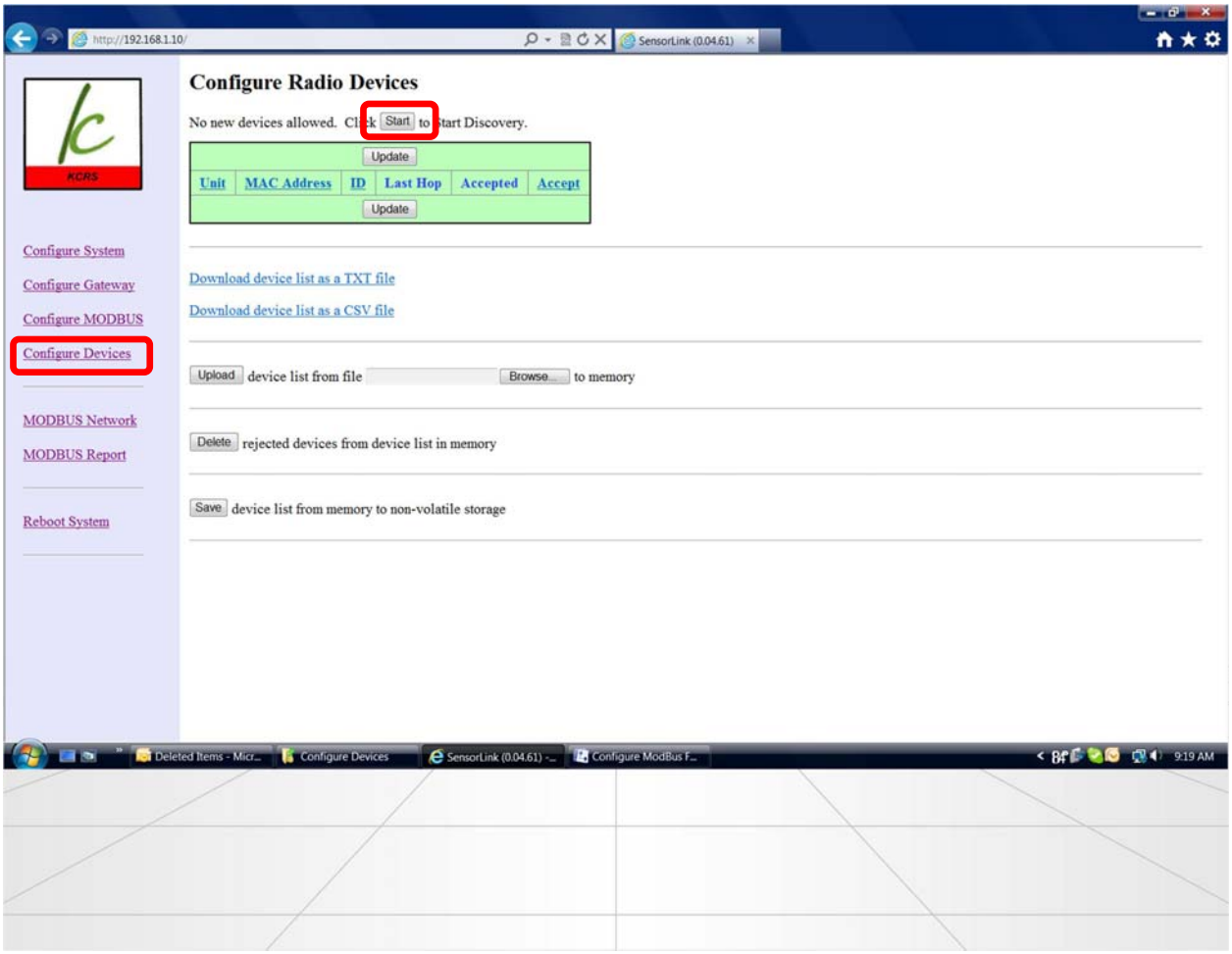
After Logging in you will automatically be directed to the Modbus Network page. If there are no devices configured the page will look like this.



The navigation links on the left hand side of the screen are the only active links at this time. When you add devices to the EC1, active links on the device pages will be enabled.

Discovering the Devices

Select “Configure Devices” and you will navigate to this screen shown below.



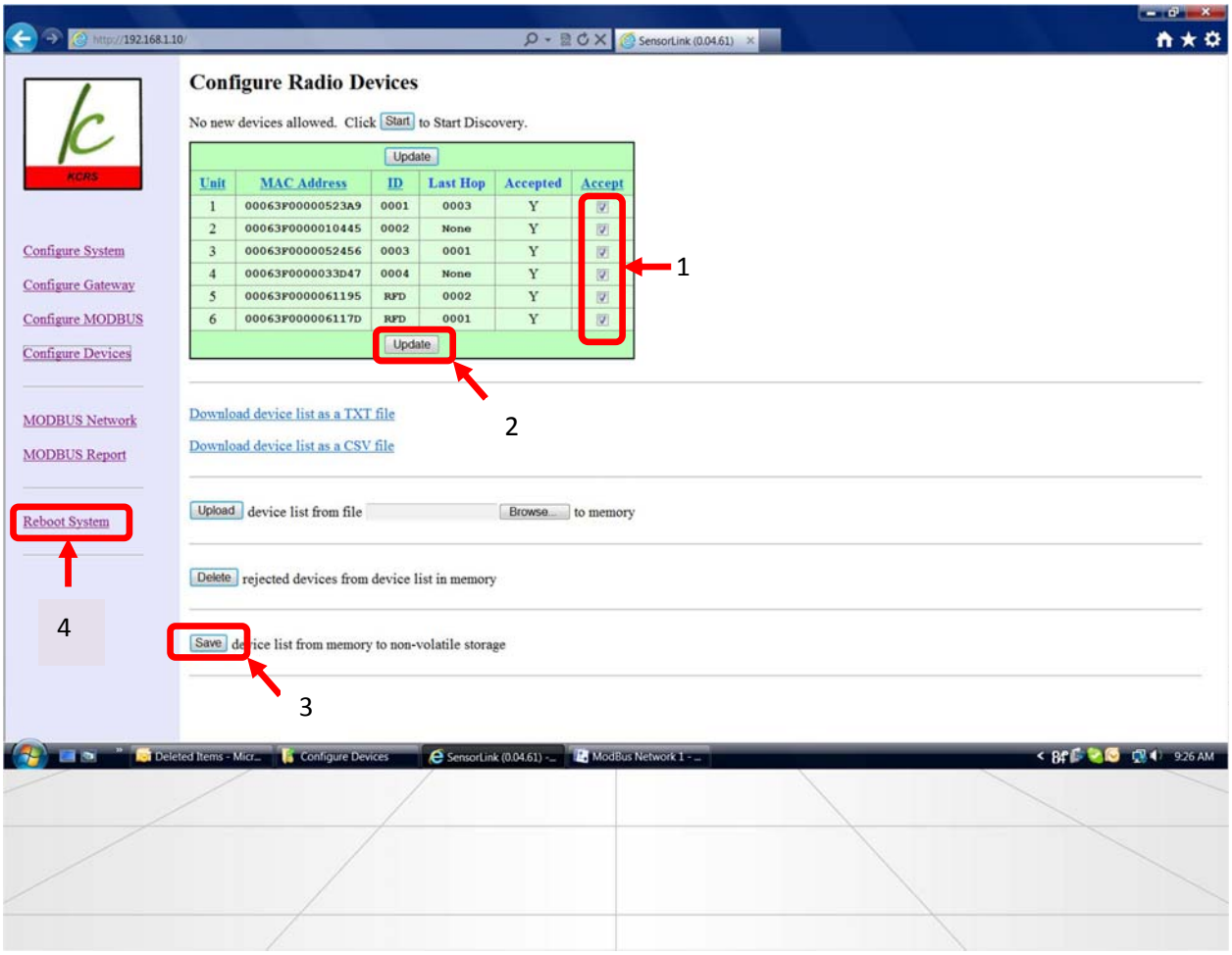
Select the “Start” button above the Device List Window. At this time the EC1 PAN Coordinator sends a Unicast message which is propagated to all radios to present their data sets to the EC1. As the devices report you will notice that the LED’s on the FFD’s that were flashing 3 times per second will flash intermittently and then eventually flash at a rate of 2 seconds ON 2 seconds OFF.

This indicates that they have found the EC1 network and have presented their credentials and are ready to be assigned to this network.

When all of the FFD’s have joined they will be populated in the Device List in the random order in which they joined the Network. Select the “Stop” Discovery button.

Device List

The Device List will now look like this.


Configure Radio Devices
No new devices allowed. Click Start to Start Discovery.
Update
Unit | MAC Address | ID | Last Hop | Accepted | Accept
1 | 00063F00000523A9 | 0001 | 0003 | Y
2 | 00063F0000010445 | 0002 | None | Y
3 | 00063F0000052456 | 0003 | 0001 | Y
4 | 00063F0000033D47 | 0004 | None | Y
5 | 00063F0000061195 | RFD | 0002 | Y
6 | 00063F000006117D | RFD | 0001 | Y
Update
1
2
Configure System
Configure Gateway
Configure MODBUS
Configure Devices
MODBUS Network
MODBUS Report
Reboot System
4
Download device list as a TXT file
Download device list as a CSV file
Upload device list from file Browse... to memory
Delete rejected devices from device list in memory
Save device list from memory to non-volatile storage
3

Check the “Accept” Box on the far right of the corresponding device (s) that you wish to add to this network.

Next, select in this order and waiting for confirmation after each step: the “Update” button; then select the “Save” button on the bottom of the screen: finally select the “Reboot System” on the left hand Navigation Tree.

The Reboot process only takes a few minutes and if your Network has a large number of Devices it could take 5 minutes or more.

Important Note: You should save the device list on your Laptop or some other media when the FFD’s and RFD’s have all been added to the network.

The Discovery process time is indeterminate. It depends on several factors: the size of the network; the topology that the network constructs which is dependent on the

physical geography discussed in previous sections of this manual; and most important, how many FFD's actually communicate directly with the EC1.

Question: When is the Mesh Network not a Mesh Network?

Answer: If all 75 FFD's on a fully populated Network were outside where line of site metrics of 427 metres (1,400 ft) prevailed and were stretched in a straight line of 32 km (19.9 miles).

The above described Network would take roughly 70 hours to fully discover and form. It would also never function properly as each node from the first node, or layer of the mesh would carry dependencies for every subsequent layer, or node. By only having one node that actually communicates with the EC1 PAN Coordinator the communication traffic that node would have to handle would overload the memory buffer of the FFD and cause it to reset itself causing the mesh to reconstruct itself.

This is obviously an extreme example but the case point is valid in that the physical location of the EC1 PAN Coordinator relative to the overall network geography can be very important, especially if the number of FFD's is large.

Configuring FFD's

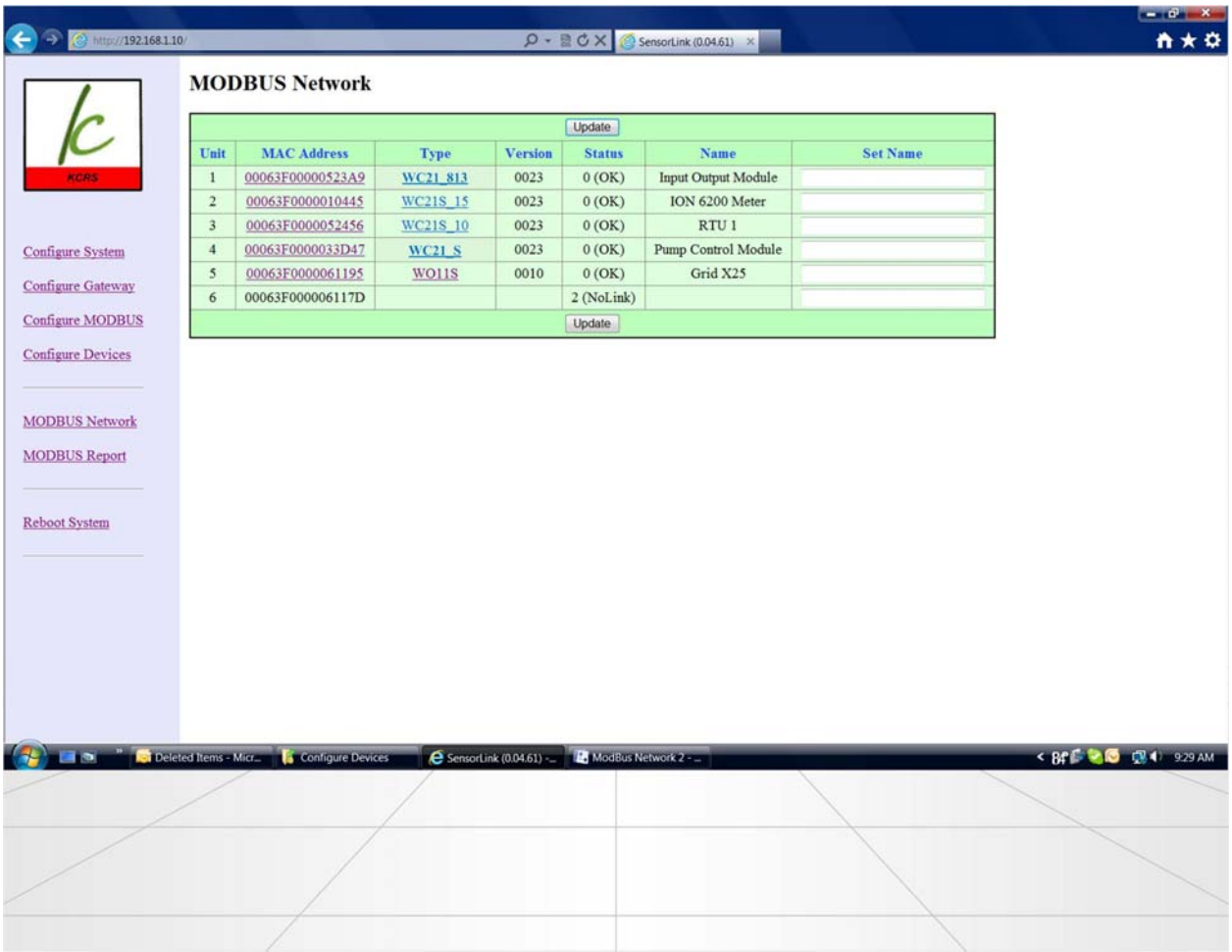
After your Discovery Process has been completed, Navigate to the Modbus Network.

The Device List reads from Left to Right:

Unit > MAC Address > Type > Version > Status > Name > Set Name

The Unit column shows the individual Nodes in the order that they were discovered.

The MAC Address is the unique ID code for each FFD and RFD and when installing the individual devices it is highly recommended that you record the device MAC Address per the location of the device, the last 5 characters is sufficient. For example: Room 304 TSTAT, or RTU 4, or HW Pump Controller, etc.



You can then simply add the naming convention that you want in the "Set Name" Write Box and then hit the "Enter" key on your PC.

The "Type" column defines the specific FFD or RFD. In the case of FFD's every device has the same first four characters WC21XXXXX.

If the WC21 is used alone without connecting the RS485 serial port to any of the ECOMM I/O modules or other 3rd Party devices which have been characterized it will show in the Type Column as a WC21_S.

In this application the Inputs and Outputs of the WC21 are controllable on the device.

Once the serial port of the WC21 is connected to an RS485 RTU slave device that has been characterized it will assume the identity of that device automatically.

In the picture on Page 30, Unit Number 2 is defined as WC21S_15. That designation is assigned to a characterized 3rd Party device which in this case is a Schneider Electric Power-Logic ***ION 6200*** 3 Phase Power Meter.

The “Version” column defines the Firmware Version of the FFD or RFD radio chipset.

The “Status” column shows the current radio Link Status. This Data Register for FFD’s has only two possible values, either “OK” or “NoLink”.

If an individual node radio link is lost it continuously tries to recover or heal, by establishing an alternate route path. If after 10 Minutes it cannot establish a link the Status of that unit shows “NoLink”.

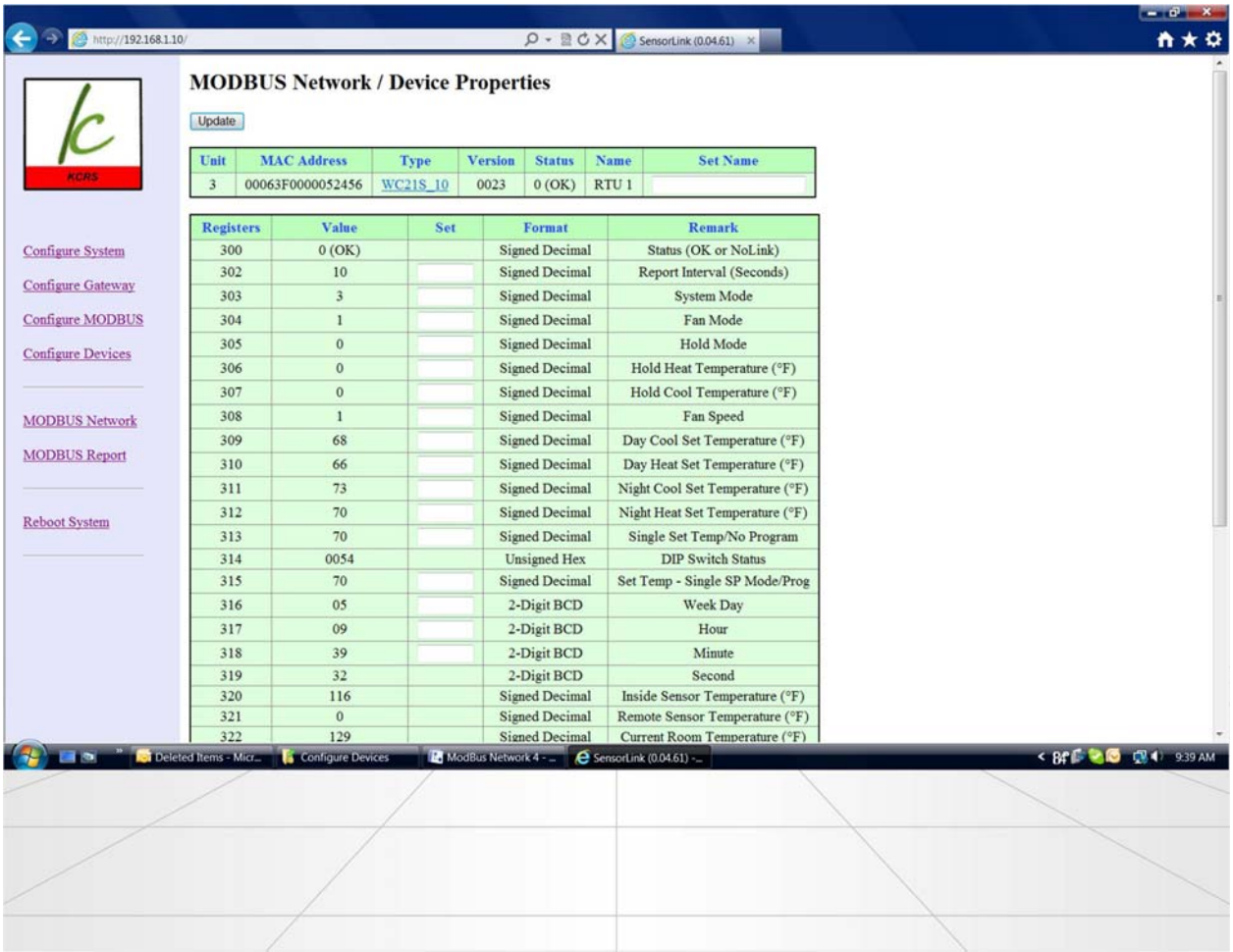
In some instances it may be necessary to generate an alarm condition at the end user control engine sooner than 10 minutes. If this is the case you can associate the alarm condition to an individual data register on the node itself which would always be varying in value and as a result would be changing at the EC1 per the reporting interval time of that individual node. An example of that would be virtually any of the meter values on Unit Number 2, the ION 6200 Meter. The readings of the values for Amps, Volts, Frequency and Power Factor are broadcast as whole Integers factored at the control engine by decimal 0.1. Or in the case of the WC21S_10 designation which is in fact the WT770 Thermostat that has as register X19 the Clock Value Time Seconds for the thermostat display. On the WC21 Register X28 is the Timestamp LSW and will change Value in Seconds at the Report Interval.

10 Seconds is the fastest Report Interval that can be set at an individual FFD Node.

Modbus Registers

By clicking on the MAC Address of an individual FFD Node you will bring up its Register Map. Each FFD on the ECOMM network is allotted 100 registers beginning with Unit 1 at 100 through 199, Unit 2 at 200 through 299 and so on.

The FFD radio data uses 19 of the 100 registers, for data associated strictly with the radio node itself. Name, Status, Version, Type, Signal Strength, etc.



Unit	MAC Address	Type	Version	Status	Name	Set Name
3	00063F0000052456	WC21S_10	0023	0 (OK)	RTU 1	

Registers	Value	Set	Format	Remark
300	0 (OK)		Signed Decimal	Status (OK or NoLink)
302	10		Signed Decimal	Report Interval (Seconds)
303	3		Signed Decimal	System Mode
304	1		Signed Decimal	Fan Mode
305	0		Signed Decimal	Hold Mode
306	0		Signed Decimal	Hold Heat Temperature (°F)
307	0		Signed Decimal	Hold Cool Temperature (°F)
308	1		Signed Decimal	Fan Speed
309	68		Signed Decimal	Day Cool Set Temperature (°F)
310	66		Signed Decimal	Day Heat Set Temperature (°F)
311	73		Signed Decimal	Night Cool Set Temperature (°F)
312	70		Signed Decimal	Night Heat Set Temperature (°F)
313	70		Signed Decimal	Single Set Temp/No Program
314	0054		Unsigned Hex	DIP Switch Status
315	70		Signed Decimal	Set Temp - Single SP Mode/Prog
316	05		2-Digit BCD	Week Day
317	09		2-Digit BCD	Hour
318	39		2-Digit BCD	Minute
319	32		2-Digit BCD	Second
320	116		Signed Decimal	Inside Sensor Temperature (°F)
321	0		Signed Decimal	Remote Sensor Temperature (°F)
322	129		Signed Decimal	Current Room Temperature (°F)

The register format is displayed with a general description in the “Remark” column.

In the “Set” column if there is a white box the Register is a “Read/Write” Register. If no white box, it is a “Read Only” value.

WC21 Register Map

Update

Unit	MAC Address	Type	Version	Status	Name	Set Name
4	00063F0000033D47	WC21_S	0023	0000 (OK)	Pump Control Module	

Registers	Value	Set	Format	Remark
400	0000 (OK)		Unsigned Hex	Status (OK or NoSink or Low Battery)
401	3300		Signed Decimal	Power Voltage (mV)
402	10		Signed Decimal	Report Interval (Seconds)
403	0		Signed Decimal	Temperature 1 (°F) or Value 1
404	0		Signed Decimal	Temperature 2 (°F) or Value 2
405	0		Signed Decimal	Digital Relay Output 1
406	0		Signed Decimal	Digital Relay Output 2
407	0		Unsigned Decimal	Pulse Count 1 Bin
408	0		Unsigned Decimal	Pulse Count 1 Bin
409	0		Unsigned Decimal	Pulse Count 1 Bin
410	0		Unsigned Decimal	Pulse Count 1 Bin
411	0		Unsigned Decimal	Pulse Count 1 Bin
412	0		Unsigned Decimal	Pulse Count 1 Bin
413	0		Unsigned Decimal	Pulse Count 1 Bin
414	0		Unsigned Decimal	Pulse Count 1 Bin
415	0		Unsigned Decimal	Pulse Count 2 Bin
416	0		Unsigned Decimal	Pulse Count 2 Bin
417	0		Unsigned Decimal	Pulse Count 2 Bin
418	0		Unsigned Decimal	Pulse Count 2 Bin
419	0		Unsigned Decimal	Pulse Count 2 Bin
420	0		Unsigned Decimal	Pulse Count 2 Bin
421	0		Unsigned Decimal	Pulse Count 2 Bin
422	0		Unsigned Decimal	Pulse Count 2 Bin
423	0		Unsigned Decimal	Pulse Accumulator 1 MSW
424	0		Unsigned Decimal	Pulse Accumulator 1 LSW
425	0		Unsigned Decimal	Pulse Accumulator 2 MSW
426	0		Unsigned Decimal	Pulse Accumulator 2 LSW
427	0		Unsigned Decimal	Timestamp MSW (Seconds)
428	0		Unsigned Decimal	Timestamp LSW (Seconds)
429	11160		Signed Decimal	Delta T (F)
430	0000		Unsigned Hex	Mode (In 2 – 5:3, In – 2:0)
431	60		Signed Decimal	Bin interval (Seconds)
481	-51		Signed Decimal	Signal (dbm)
482 to 485	00063F0000033D47		Unsigned Hex	MAC Address
486	0001		Unsigned Hex	Type (0001)
487	0023		Unsigned Hex	Firmware Version
488 to 499	Pump Control Module		Text	Device Name

These Registers are Bin Increments associated with Input 1 when configured as a Pulse Input. Increment time value is set in Register 431. That value is used for both Pulse Inputs.

Bin Increments for Pulse Input 2.

Value	Input 1	Input 2
0000	Contact Pulse	Contact Pulse
0001	30 K Ohm T	Contact Pulse
0008	Contact Pulse	30 K Ohm T
0009	30 K Ohm T	30 K Ohm T

Register X30 Sets the orientation of both Inputs of the WC21.

Register X81 is the RF Link Value

At -30 dbm Link is Perfect
At -95 dbm Link is Lost
At -85 dbm 95% Packet Throughput
At -80 dbm 98% Packet Throughput
At -75 dbm 100% Packet Throughput

When the RS485 RTU Communication Port is Connected to any 3rd Party Device the on board Inputs and Outputs of the WC21 are rendered inoperative.

In that Mode the WC21 identifies the 3rd Party Device and presents the 3rd Party Device Register Map.

WC21-813 Register Map

MODBUS Network / Device Properties

Update

Unit	MAC Address	Type	Version	Status	Name	Set Name
3	00063F00000523A9	WC21S_813	0023	0000 (OK)	Input Output Module	

Registers	Value	Set	Format	Remark
300	0000 (OK)		Unsigned Hex	Status (OK or NoLink)
302	10		Signed Decimal	Report Interval (Seconds)
303	809		Signed Decimal	Analog Input
304	691		Signed Decimal	Analog Input
305	593		Signed Decimal	Analog Input
306	0		Signed Decimal	Analog Input
307	0		Signed Decimal	Analog Input
308	1022		Signed Decimal	Analog Input
309	1022		Signed Decimal	Analog Input
310	1022		Signed Decimal	Analog Input
311	0		Signed Decimal	Digital Relay Output
312	0		Signed Decimal	Digital Relay Output
313	0		Signed Decimal	Digital Relay Output
314	0		Signed Decimal	Digital Relay Output
315	0		Signed Decimal	Digital Relay Output
316	0		Signed Decimal	Digital Relay Output
317	0		Signed Decimal	Digital Relay Output
318	0		Signed Decimal	Digital Relay Output
319	0		Signed Decimal	Digital Relay Output
320	0		Signed Decimal	Digital Relay Output
321	0		Signed Decimal	Digital Relay Output
322	0		Signed Decimal	Digital Relay Output
323	0		Signed Decimal	Digital Relay Output
324	AAA8		Unsigned Hex	Override Switch
325	AA80		Unsigned Hex	Override Switch
381	-35		Signed Decimal	Signal (dbm)
382 to 385	00063F00000523A9		Unsigned Hex	MAC Address
386	0003		Unsigned Hex	Type (0003)
387	0023		Unsigned Hex	Firmware Version
388 to 399	Input Output Module		Text	Device Name

Universal Inputs

10 Bit Resolution

0-5 VDC / 0-20 ma / Contact / 10 K Ohm Thermistor T III

Action Jumper Selectable

Digital Outputs

Form A

HOA Switch for Each

Rating 1 Amp 30 VAC VDC

Write Value > 1000 Turns On Output

Write Value = 0 Turns Off Output

WT770 Register Map

MODBUS Network / Device Properties

Update

Unit	MAC Address	Type	Version	Status	Name	Set Name
1	00063F0000052456	WC21S_10	0023	0 (OK)	RTU 1	

Registers	Value	Set	Format	Remark
100	0 (OK)		Signed Decimal	Status (OK or NoLink)
102	10		Signed Decimal	Report Interval (Seconds)
103	3		Signed Decimal	System Mode
104	1		Signed Decimal	Fan Mode
105	0		Signed Decimal	Hold Mode
106	0		Signed Decimal	Hold Heat Temperature (°F)
107	0		Signed Decimal	Hold Cool Temperature (°F)
108	1		Signed Decimal	Fan Speed
109	68		Signed Decimal	Day Cool Set Temperature (°F)
110	66		Signed Decimal	Day Heat Set Temperature (°F)
111	73		Signed Decimal	Night Cool Set Temperature (°F)
112	70		Signed Decimal	Night Heat Set Temperature (°F)
113	70		Signed Decimal	Single Set Temp/No Program
114	0054		Unsigned Hex	DIP Switch Status
115	70		Signed Decimal	Set Temp – Single SP Mode/Prog
116	00		2-Digit BCD	Week Day
117	10		2-Digit BCD	Hour
118	39		2-Digit BCD	Minute
119	31		2-Digit BCD	Second
120	116		Signed Decimal	Inside Sensor Temperature (°F)
121	0		Signed Decimal	Remote Sensor Temperature (°F)
122	129		Signed Decimal	Current Room Temperature (°F)
123	68		Signed Decimal	Set Temperature (°F)
124	0		Signed Decimal	Display F=0, C=1
125	000B		Unsigned Hex	Relay outputs
126	1		Signed Decimal	Night=0, Day=1
127	218		Unsigned Decimal	T770 Firmware Version
128	0		Signed Decimal	Relay Override
129	50		Signed Decimal	Temperature (.1°C)
130	0		Signed Decimal	Temperature (.1°F)
181	-55		Signed Decimal	Signal (dbm)
182 to 185	00063F0000052456		Unsigned Hex	MAC Address
186	000A		Unsigned Hex	Type (10)
187	0023		Unsigned Hex	Firmware Version
188 to 199	RTU 1		Text	Device Name

Write Value of 1 Disables Thermostat Relays for Control by Other Logic Engine

Inside Sensor Value Offset by 40, End User Control Engine must subtract. Thermostat Displays corrected Value. (76 F)

Configuring RFD's

After the FFD Discovery and Configuration process has been completed navigate back to the "Configure Devices" link.

As previously suggested all RFD's would not have been powered up during the FFD Discovery and Configuration process. There are two reasons for this.

First, since all the RFD's are battery powered devices and can only communicate with the FFD's and not directly with the PAN Coordinator, if you were to install the batteries in the RFD's, after 192 Seconds the RFD's start searching for the FFD mesh nodes, which without the PAN Coordinator would not be able to construct the mesh and thereby place the RFD's into network alignment. In short the batteries which should normally last for between 2 to 4 years would deplete within 36 hours without the mesh network established.

Second, from a device management standpoint it is a cleaner, more discernable Device List that the Integrator will have at the conclusion of the process.

At this point "Start" Discovery a second time and leave it on until the following two actions are completed.

Go to the location of each installed RFD and install the batteries in the device.

While the chassis of the device is separated before you re-attach it, "Push and Release" the white "Bind" button on the back of the circuit board and mount the RFD in its final position.

The RFD will associate from a mesh architecture standpoint with the best available FFD.

After you have repeated this process for each RFD, observe the Device List to make sure that all RFD's have been discovered. Once they have all been discovered "Stop" the Discovery process and then check the accept box for each.

You must perform the "Update", "Save" and "Reboot" functions a second time. Now all of the network information is stored in non-volatile memory on all the devices in the network

The Device List for the RFD's is the same column order:

Unit > MAC Address > Type > Version > Status > Name > Set Name

The same methods of writing to variables in the FFD's applies to RFD's.

WT11SH1 Register Map

Unit	MAC Address	Type	Version	Status	Name	Set Name
7	00063F0000062D08	WT11SH1	0021	0001 (LowBattery)		

Registers	Value	Set	Format	Remark
5800	0001 (LowBattery)		Unsigned Hex	Status (OK or NoLink or LowBattery)
5801	3280		Signed Decimal	Power Voltage (mV)
5802	8		Signed Decimal	Report Interval (Seconds)
5803	79		Signed Decimal	Temperature (°F)
5804	90		Signed Decimal	Humidity (%)
5805	67		Signed Decimal	Temperature Setpoint (°F)
5806	50		Signed Decimal	Humidity Setpoint (%)
5807	0007		Unsigned Hex	Override, Top Left, Bottom Left
5808	0000		Unsigned Hex	Heat/Cool, High/Low
5809	1		Signed Decimal	0 = Fahrenheit/1 = Celcius
5882 to 5885	00063F0000062D08		Unsigned Hex	MAC Address
5886	0043		Unsigned Hex	Type (0043)
5887	0021		Unsigned Hex	Firmware Version
5888 to 5899			Text	Device Name

The RFD's have the same allotment of Modbus register slots as the FFD's, as in the example above, 100 registers per node on the EC1 PAN Coordinator, but in reality have far fewer actual data registers.

The RFD's have one additional "Status" code which is "Low Battery" condition.

The RFD will process the Low Battery Condition at 2745 mV, but will continue to operate until a value of 1800 mV is reached, at which point the CPU of the RFD shuts down.

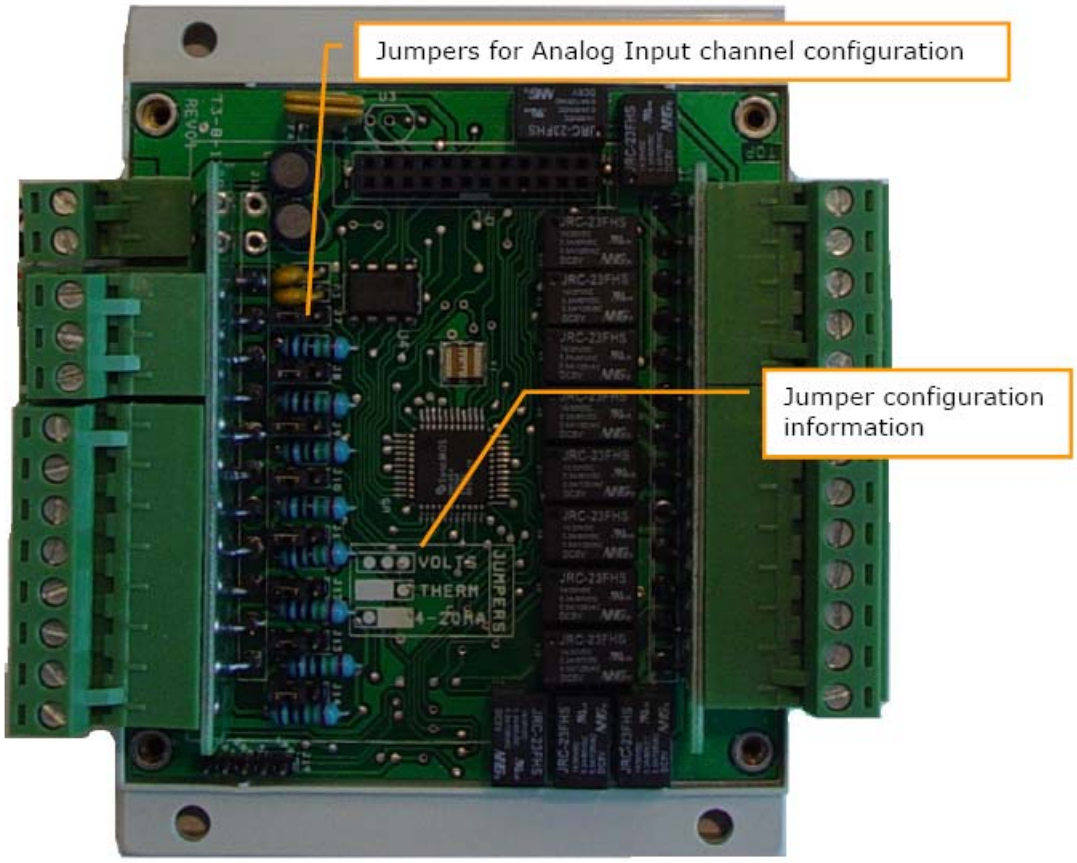
Input / Output Modules Channel Function Selection

Any of the I/O Modules (WC21-88 / WC21-813 / WC21-32) have configurable inputs on an individual Input Channel basis. These configuration settings are not accomplished over the Mesh Network. They are manually done by jumper position selection on each I/O Module for each Input Channel.

Power to the I/O Module must be turned off before proceeding.

To set the jumpers, remove the 4 screws that secure the front cover of the I/O Module and carefully remove the cover.

Next remove the Daughter board which exposes the Jumper Pins.



WC21-813

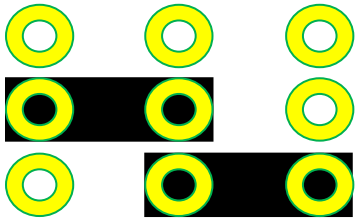
Jumper placement differs for each of the I/O Modules, the positioning legend for each Module is beneath the Module cover and visible when the daughter-board is removed.

WC21-813 Jumper Positions

0-5VDC

Therm/Contact

0-20 ma

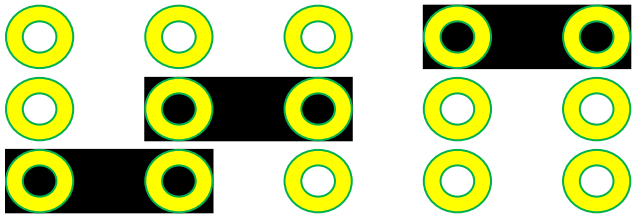


WC21-32 Jumper Positions

0-5VDC

0-20 ma

Therm/Contact

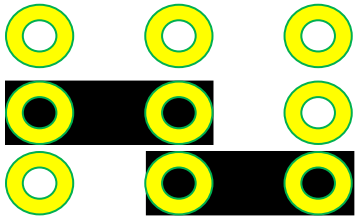


WC21-88 Jumper Positions

0-5VDC

0-20 ma

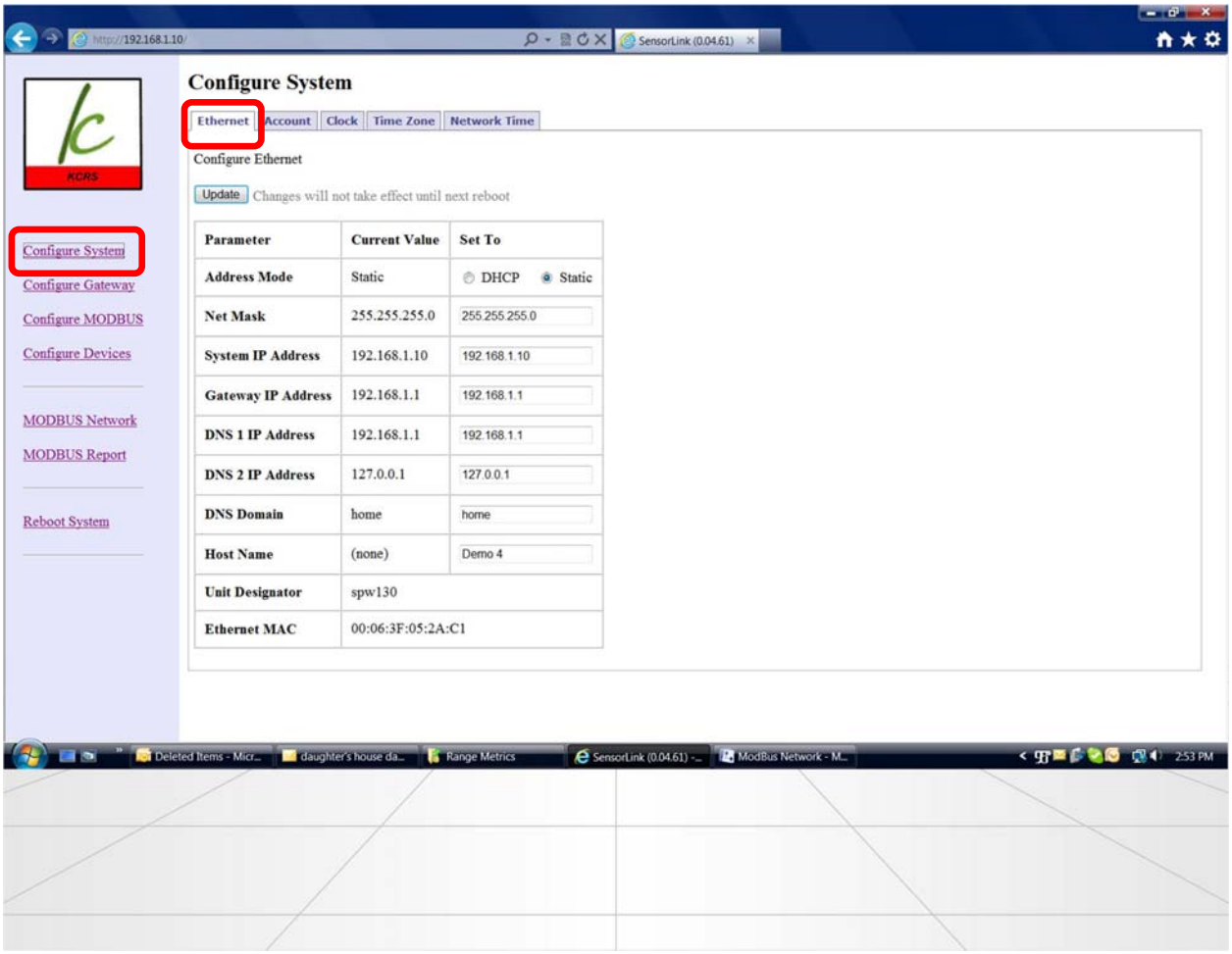
Therm/Contact



Review each module's Data Sheet for wiring details and application notes and suggestions.

EC1 Configuration Details

EC1 Ethernet/IP Configuration Settings



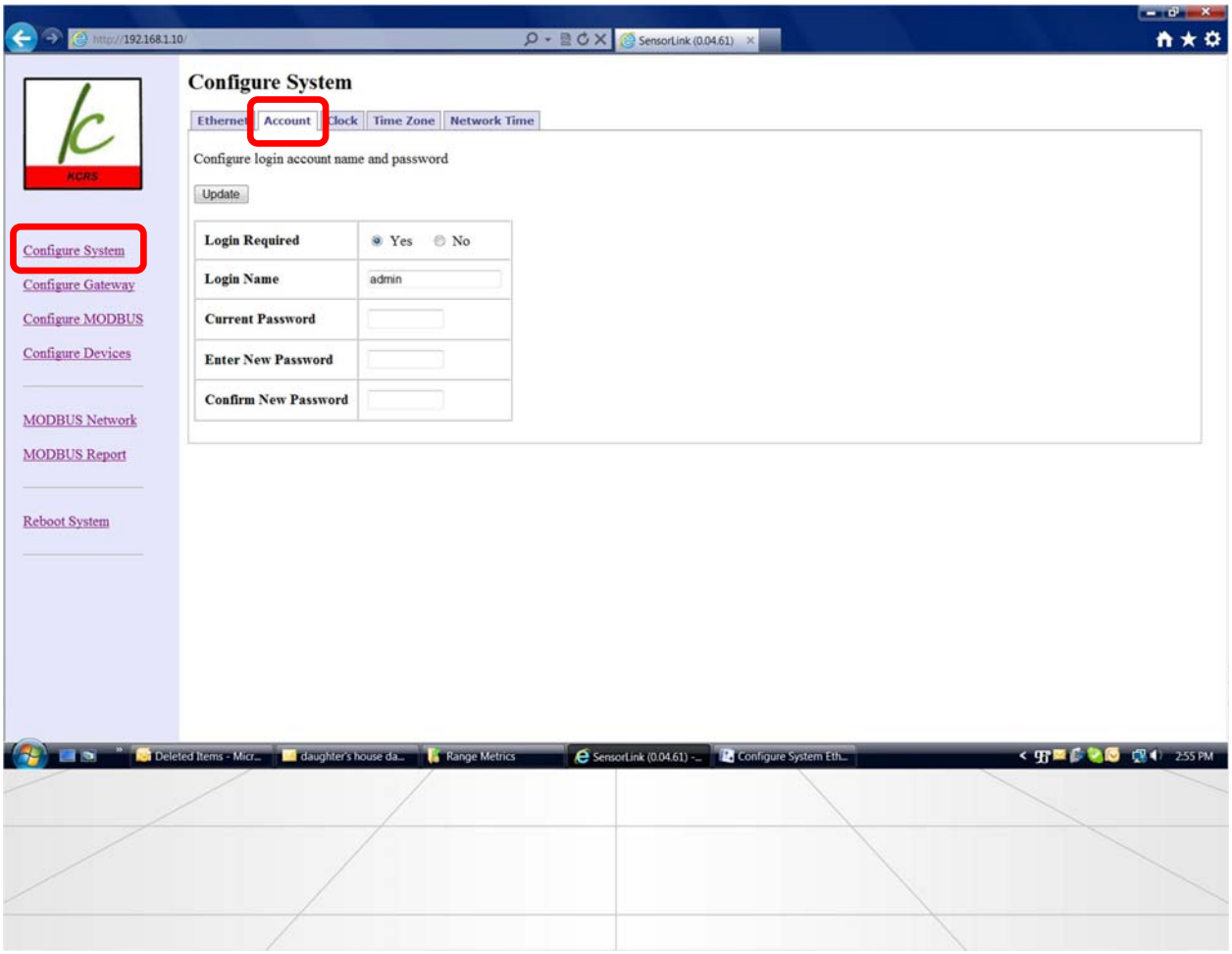
See EC1 Data Sheet for full specifications.

If EC1 is set for DHCP Mode and Port 5000 is open for Outgoing Traffic, the EC1 will have 4 Green LED's (ON) on the front bezel. In this state the EC1 can be accessed by the factory for firmware upgrade. This includes the ability to upgrade the firmware image of the FFD and RFD mesh nodes.

When requesting a firmware upgrade, the only data the factory needs is the "Unit Designator" alpha-numeric code, example "spw130" as shown above.

Changes to settings will not take effect until the "Update" button has been selected and System has been "Rebooted".

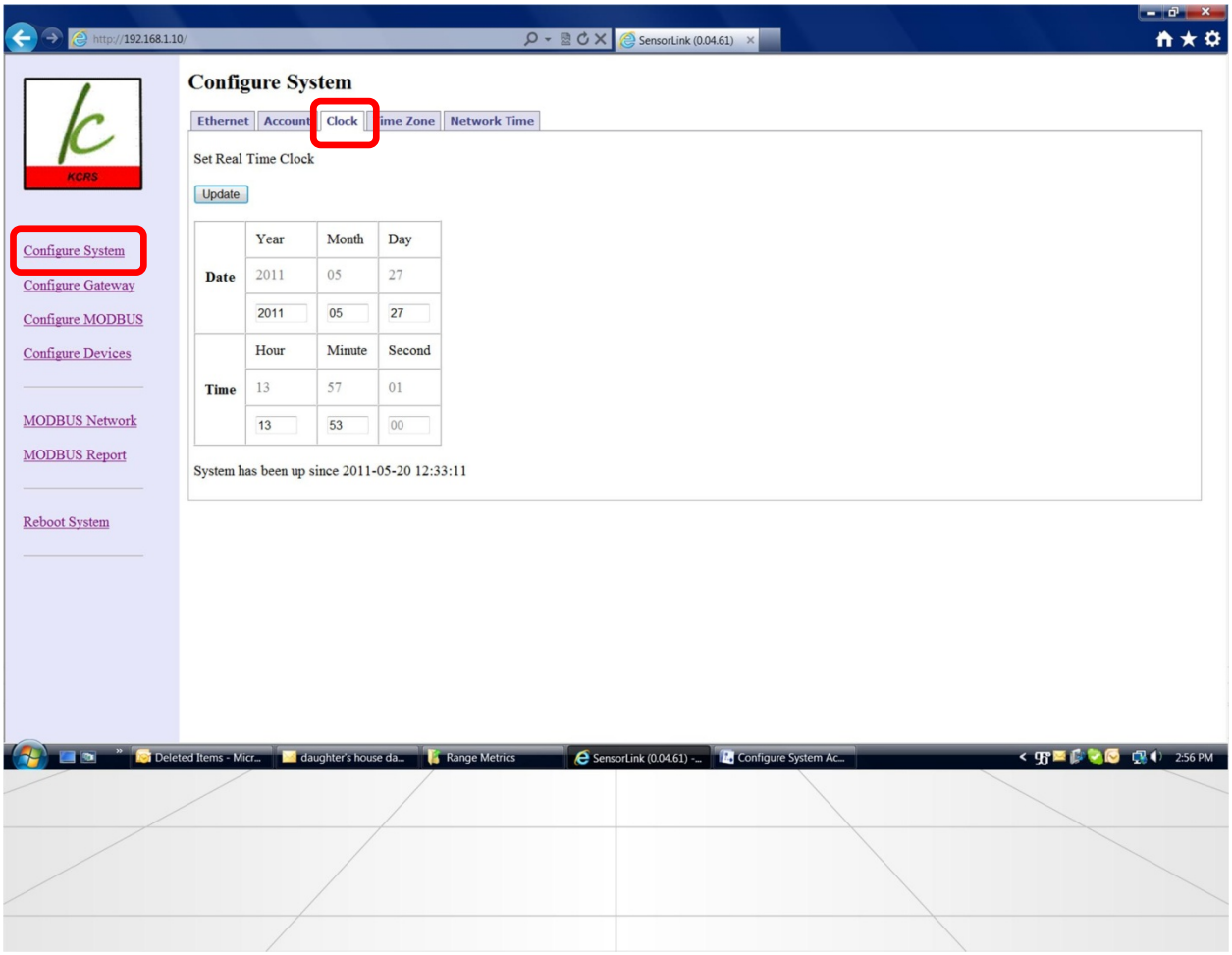
User Configuration Settings



Default User = admin / Default Password = password.

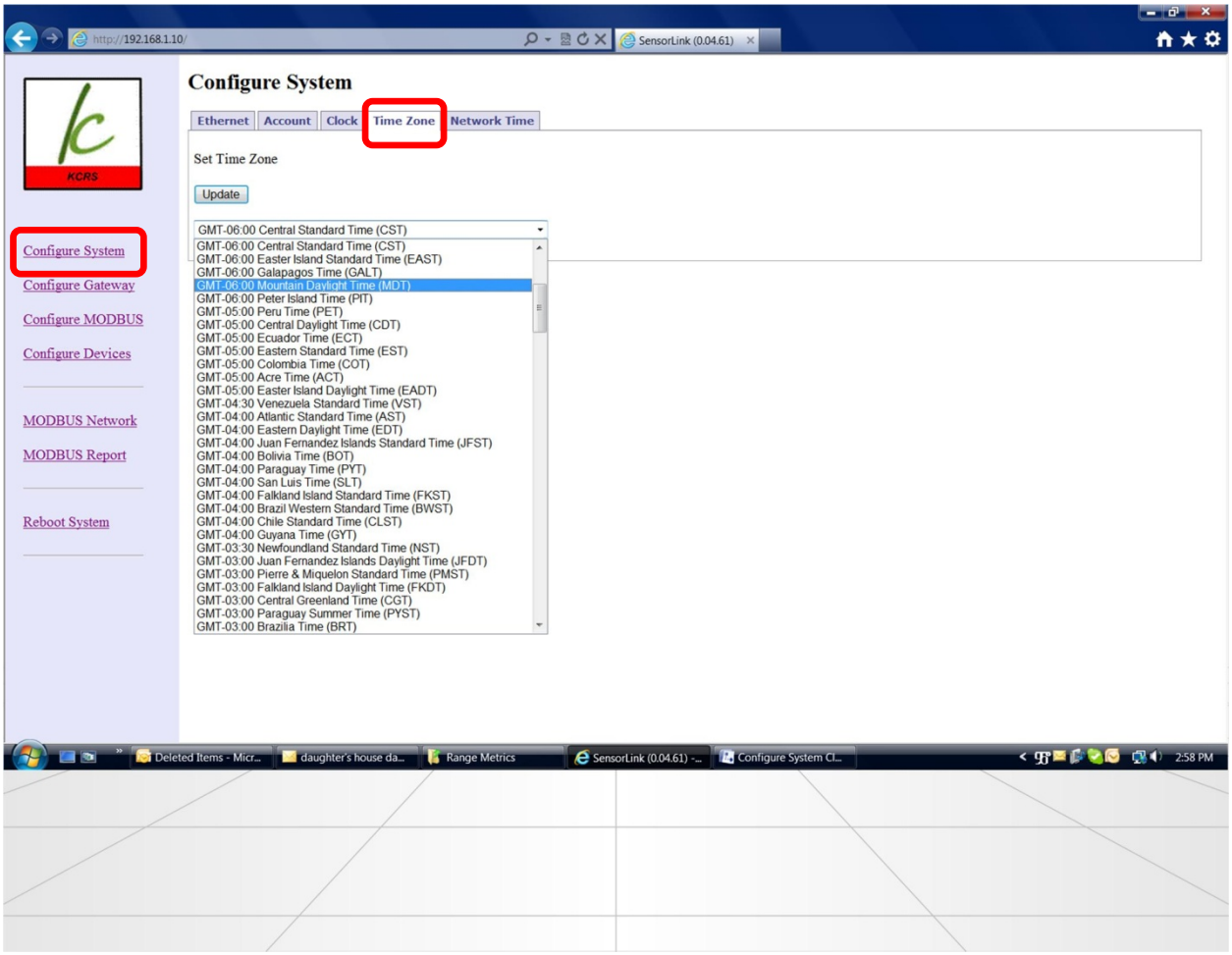
Changes to settings will not take effect until the “Update” button has been selected and System has been “Rebooted”.

EC1 System Clock Configuration Settings



Internal battery will maintain clock operation for 300 Hours when power is disconnected.

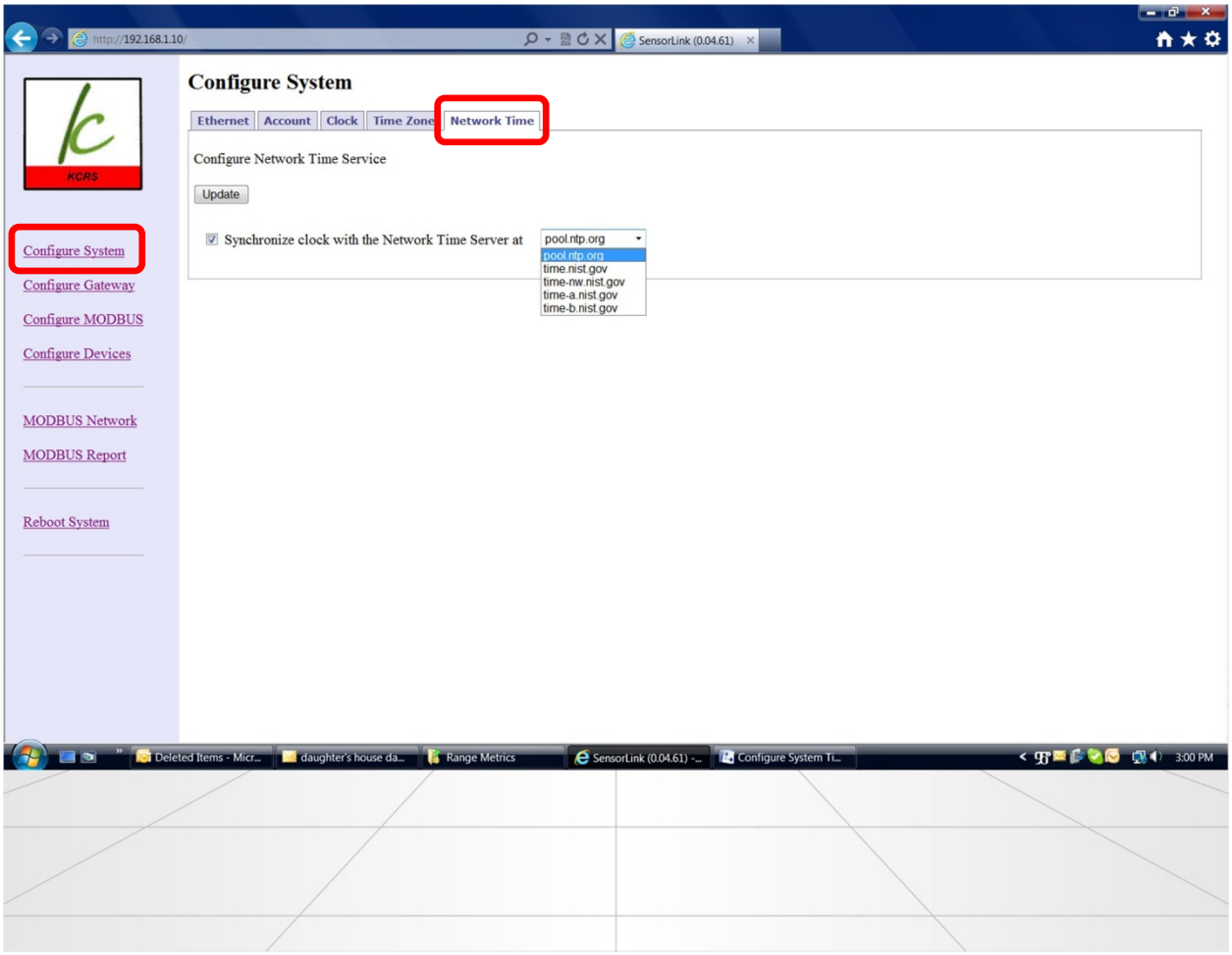
EC1 Time Zone Configuration Settings



Select appropriate Time Zone (GMT +/- X).

Changes to settings will not take effect until the “Update” button has been selected and System has been “Rebooted”.

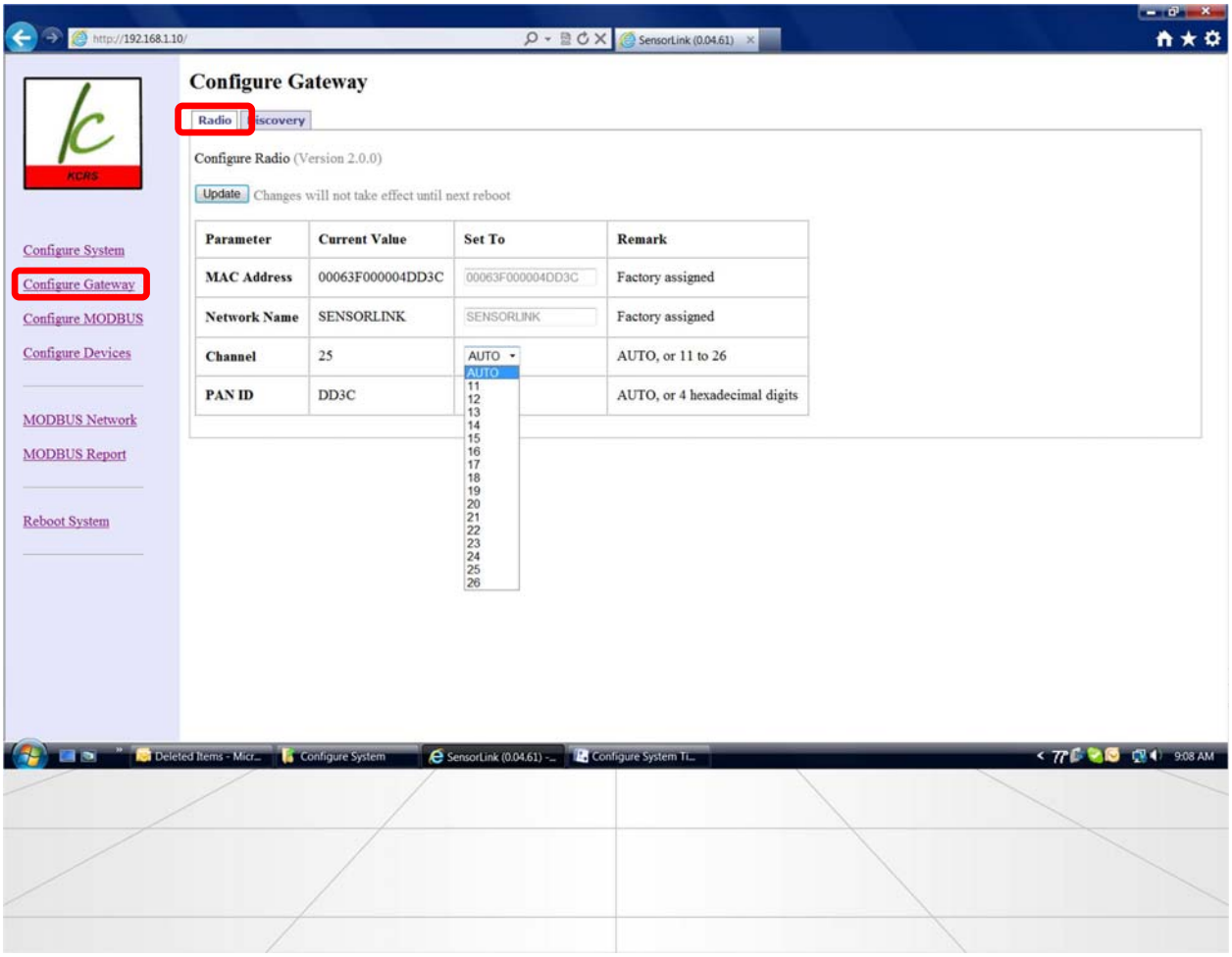
EC1 Network Time Configuration Settings



Choose to either synchronize or not synchronize with one of the pre-selected standard sites. The EC1 must have Port 80 and Port 5000 open on the site infrastructure for this function to be available. In Europe. where in many countries clocks move forwards one hour in the Spring and backwards one hour in the Autumn, it is common to leave the time clock on plant equipment set to GMT so that there is a consistent time basis for the recorded data year-round.

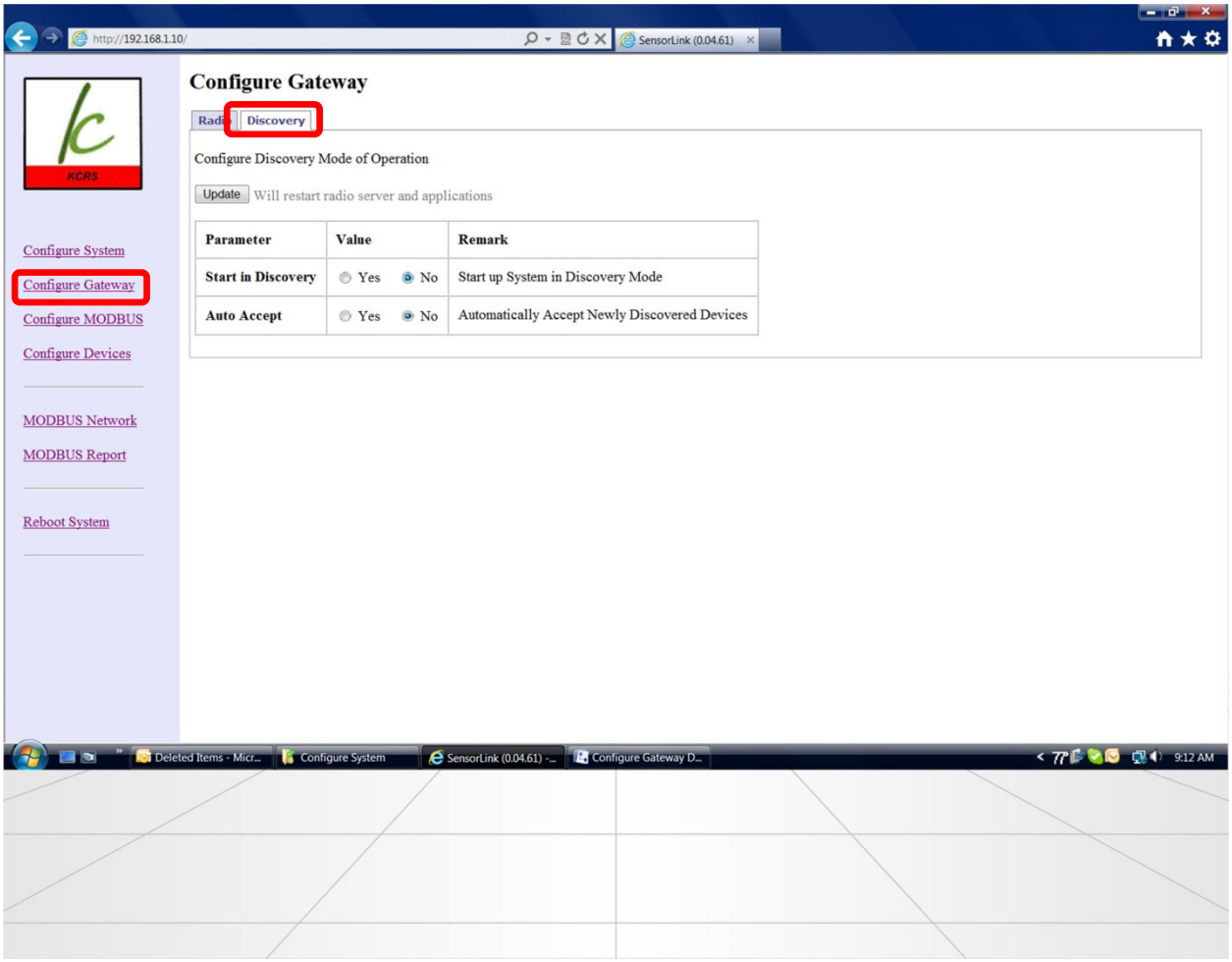
Changes to settings will not take effect until the “Update” button has been selected and System has been “Rebooted”.

Configure Gateway Radio



The EC1 comes from the factory with default settings as to how the gateway radio operates in the 2.4 GHz band. In Channel selection you have the option of allowing the Frequency Hopping feature of the ECOMM protocol to migrate to the least saturated Channel of the spectrum, which it does automatically and continuously. Alternatively you may select a fixed Channel which the Network will operate on. ***This is not recommended***, but there may be instances with particular end user sites that have restrictions on certain Channels.

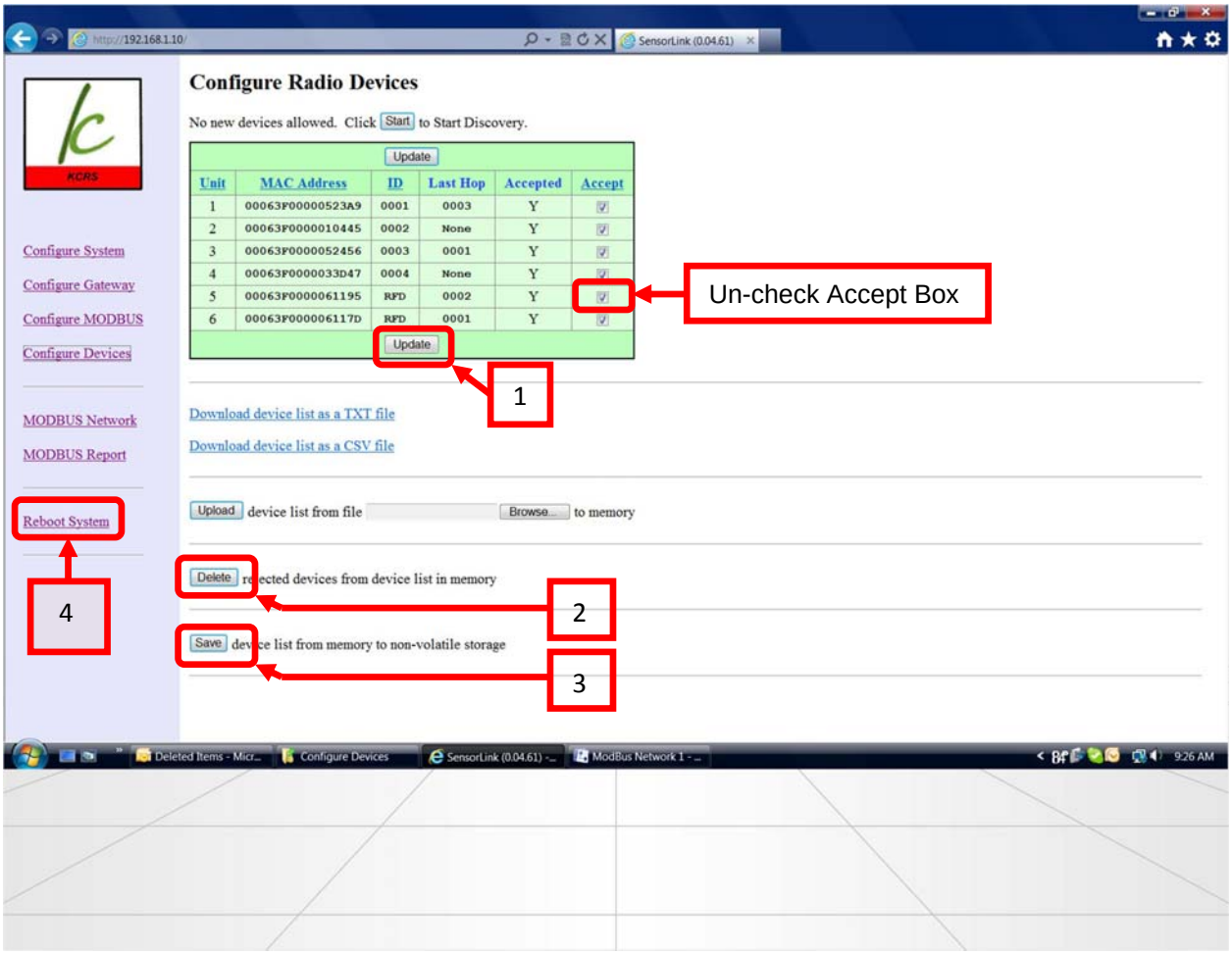
Configure Gateway Discovery



The EC1 comes from the factory with Discovery Mode and Accepting FFD and RFD Nodes by manual selection. At a site where there were a limited number of devices to be on the network using the Auto Modes for both of these functions would not present a problem. However, where there were hundreds of Devices destined to be on specific networks by geographic design using auto functions would complicate your network construction efforts.

See the section on Page 47 for de-selecting nodes.

Removing FFD or RFD Nodes from a Network


Configure Radio Devices
No new devices allowed. Click Start to Start Discovery.
Update
Unit | MAC Address | ID | Last Hop | Accepted | Accept
1 | 00063F00000523A9 | 0001 | 0003 | Y
2 | 00063F0000010445 | 0002 | None | Y
3 | 00063F0000052456 | 0003 | 0001 | Y
4 | 00063F0000033D47 | 0004 | None | Y
5 | 00063F0000061195 | RFD | 0002 | Y
6 | 00063F000006117D | RFD | 0001 | Y
Update
Un-check Accept Box
1
Configure System
Configure Gateway
Configure MODBUS
Configure Devices
MODBUS Network
MODBUS Report
Reboot System
Download device list as a TXT file
Download device list as a CSV file
Upload device list from file
Browse...
to memory
Delete
2
Save
3
4

In this instance we want to remove a node or nodes that were inadvertently added to this EC1 network.

To allow the FFD or RFD to join another network you must first remove it from the network it is currently assigned to.

Navigate to “Configure Devices” link. Uncheck the “Accept” box in the Device List for the MAC Address of the FFD (s) or RFD (s) you want to remove. Then select in this order, “Update”, then “Delete”, then “Save” and finally “Reboot”.

You have removed the device (s) and created a new Device List which should be saved on some other media in addition to the EC1. Should an EC1 ever fail you can simply upload the Device List to the replacement EC1 and no other configuration will be necessary.

Characterized 3rd Party Device Settings

ECOMM Series WC21 Supported Electric Meters

Use these settings for meters supported by ECOMM Series WC21 FFD via RS485 RTU Serial Communication Port.

Manufacturer	Model	Unit ID #	Baud Rate	Parity	Data bits	Stop
Schneider	E 5600	102	9600	None	8	1
Schneider	ION 8600	101	9600	None	8	1
Schneider	PM 710/750	1	19200	None	8	1 **
Schneider	PM 9C	1	19200	None	8	1
Schneider	ION 6200	124	9600	None	8	1
Carlo Gavazzi	EM24	7	9600	None	8	1
Veris	H 8036	1	9600	None	8	1
EIG	Shark 100	17	9600	None	8	1

Notes:

1. When using the WC21 as an RTU RS485 connection to any 3rd Party Modbus Device the on board I/O of the WC21 are disabled, as the FFD must assume the identity of the connected slave device.
2. The WC21 can be powered with 12VDC or 24VAC.
3. Verify correct polarity of the RTU connection between the WC21 and Slave Device.
4. Connect the WC21 to the 3rd Party Device communication and power before discovering or admitting the node to the mesh network.
5. If you are employing in excess of 25 meters on any single mesh network you may have to limit the FFD reporting interval to no less than 60 seconds. The performance of the network is dependent upon the mesh architecture unique to your site.

****** Schneider PM710 Data Registers are a Sub-Set of the PM750

3rd Party Devices

As has been mentioned in this manual and in other ECOMM product documents, products from 3rd party manufacturers, whose devices communicate via various serial physical connections can be characterized to have a unique identity on the ECOMM mesh network. In the examples presented in this manual each instance of various devices are Modbus RTU RS485 Serial communication between the FFD Node and the 3rd party product. The communication protocol over the mesh network is proprietary up to the PAN Coordinator, where at that point it is presented to the End User Control Engine Platform as Modbus TCP registers per device.

ECOMM FFD Nodes can be manufactured with various serial physical connections, either RS232, I^2C, TTL or other forms of serial communication.

The process to have a 3rd party device “Characterized” may be quite simple or quite complicated. If the device employs Modbus RTU RS485 communication we simply need to acquire a sample of the product and the desired data registers to be associated with that device.

If the 3rd Party device is other than Modbus RTU RS485 and employs a proprietary communication protocol we would need the protocol from the manufacturer.

The process normally takes 2 weeks and there may be Non-Recurring Engineering costs involved.

End of Document